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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1319 — **An Agricultural Journey through the Belgian Congo.** — LEPLAE, E., *Ministère des Colonies de Belgique, Direction de l'Agriculture*, 44 pp. + 32 Photographs. London, 1918.

Since being taken again by Belgium in 1908, the Belgian Congo has developed to an astonishing extent. Not even the war could stop its economic progress. Twenty years ago the Colony was considered an unhealthy country with limited resources which Belgium could only administer and civilise at great expense, without any hope of a good economic future. Since Belgians have learnt to appreciate better its climate, agricultural and mineral wealth, the inherent qualities of the natives and the value of its immense network of rivers, this colony has been looked upon as a rich, healthy country, essential to the reconstruction of the industrial and commercial prosperity of Belgium.

Considerable progress in agriculture has been made of recent years. Native agriculture is being rapidly developed. Important results have just been obtained in the growing of rice, oil palms and cotton. The natives are good farmers and the State sees that they reap the profit from their work. Agriculture in plantations is less advanced. There are, it is true, some large plantations belonging to societies, missions, or the State, rarely to private owners, but they increase in number very slowly and, up till now, Belgians do not appear to have given them the attention they deserve. Nevertheless, the private and State plantations have shown that tropical crops will enable active and persevering planters to make themselves an independent position in a few years.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

[Abstract No. 1319]

The little interest taken by Belgians in colonial agriculture seems chiefly due to the fact that this agriculture is little known in Belgium, perhaps also in part to the bad reputation of the Congo climate and the failure of certain agricultural undertakings of the State and plantation societies. The first difficulty is about to be solved by a decision of M. RENKEN, Minister for the Colonies, which annually allows several Belgians who may wish to settle as planters in the colony, to acquire the necessary practical knowledge at very little cost. They may be admitted as students into the plantations and breeding-stations of the Congo State and, during one year, study all the cultural and administrative work. Their number is of necessity limited and fixed in advance (only 20 in 1918). They are engaged by contract as overseers. The State pays almost all their travelling expenses, gives them 10 frs. (8s.) a day, and supplies them with a native servant and the workmen required to clear and plant a kitchen garden. The second difficulty, that of the climate, is already solved. Since Europeans find in the Congo all necessities and have learnt to protect themselves against the common diseases of hot climates, their health does not suffer in any way. The third point, the failure of the State agricultural undertakings and of certain plantation societies, no longer exists in view of the results obtained at the present time. The plantations are some years old and many are bearing (most are composed of trees which bear only when 6 to 8 years old). Experience gained during 10 years at the cost of many failures has made it possible to improve greatly the general position and the agriculturists have obtained a good knowledge of the agricultural conditions of the colony.

The Minister for the Colonies has, since January 1, 1918, placed six plantations of the State under special control. Henceforth they will be exploited commercially, as also will be the private estates. The financial results will be published annually in an appendix to the general Budget of the Colony. The aim of this is to show the public the cost and profit to the Congo of the principal colonial crops (cacao, rubber, coffee, cotton, palm, etc.). The stations which come under this new control are those of Ganda Sundi (Mayumba), Bakusu (Equator), Barmubu and Yangambi-N'Gari (Aruwini), Lula and Avakubi (Stanleyville), and Nyangwe (Maneima). The last two are not yet ready but soon will be.

Meteorological service. — A meteorological service has been organised since 1911 by the service of Agriculture. Three first-class stations have been formed — Banane, Eala and Elisabethville. Second and third class stations have been established in the State plantations and a certain number of mission centres. The Elisabethville Station, fitted up with numerous recording apparatuses and a seismograph for registering earthquakes is unique in Central Africa, both for its equipment and its position. Besides the stations under the control of the Agricultural Service, meteorological observations are made at the wireless telegraph stations. Several other observation posts were organised five years ago to help aviation.

The agricultural necessity of meteorological observations was not recognised in the colony for a long time. The difficulties met with in cotton growing at the beginning were due above all to insufficient knowledge of

the climate. Astonishing phenomena are sometimes recorded. For example, on June 8, 1916 a temperature of 39° C. at midday was recorded in the table-land in front of the Katentania, Katanga, Station, and —4° C. at 3 o'clock in the morning in the valley over 1300 ft. below, the difference in temperature being 43° C. Moreover, frost is frequent in the grassy valleys of Katanga in the dry season and makes wheat-growing difficult.

Experiment stations. — The State agricultural and breeding stations and plantations are described (1), and a summary given of the experiments made by the Agricultural Department in each. The most important private estates are also mentioned.

State agricultural stations.

(The stations marked with an asterisk have been wound up or sold to favour recolonisation).

| Stations and plantations | Principal crop or stock | Area planted or grazed, in acres | Stations and plantations | Principal crop or stock | Area planted or grazed, in acres |
|---|-------------------------|----------------------------------|---------------------------|-------------------------|----------------------------------|
| 1) Botanical Garden and Experimental Garden of Bala | | | 112) Katentania | Cattle | 19,769 |
| 2) Bakusu | Rubber | 128 | 113) Zambezi | Horses; cattle | 5,165 |
| 3) Barumbu | Cacao | 1,000 | 114) Munama | Food plants | 124 |
| 4) Lulu | Coffee | 247 | 115) Mbawasa | Puntumia | 593 |
| 5) Ganda Sundi | Cacao | 114 | | Rubber | |
| 6) Yangambi Ngazzi | Rubber | 1,106 | 116) Dundusana | | 287 |
| 7) Avakudi | Puntumia | 988 | 117) Yaumbata | | 291 |
| 8) Lembu Congo | Fruit, fibre | 185 | 118) Likimi | | 314 |
| 9) Kitobola | Irrigated rice | 805 | 119) Musa | | 359 |
| 10) Nyangwe | Purebreed stock | 244 | 120) Djombo | | 605 |
| 11) Apia | Cotton; breeding | 2,473 | 121) Lomoli | | 402 |
| | Elephants | 44 | 122) Mutambo | Breeding | 741 |
| | | | 123) Bokata | Manioc | 688 |
| | | | 124) Lunkala | Cotton | 123 |
| | | | 125) Lubolela | Puntumia | 247 |
| Total area | | | | | |
| | | 103,565 acres | | | |
| Total area of plantations of rubber, coffee, cacao, palms, etc. | | | | | |
| | | 10,448 acres | | | |

1320 - *Tsetse Flies and Fly-Belts in Africa.* - CHRISTY, C., MAJOU, R. A. M. C. (in the *Annals of Tropical Medicine and Parasitology*, Vol. XI, No. 3, pp. 279-282, Liverpool, January, 1918).

A "fly-belt" is not a region where species of *Glossina* belonging to the *morsitans* group can always be found, but a district beyond which the fly is rarely to be met with. It is known that the fly migrates *en masse* from one part of the belt to another within certain limits, a fact that, so far, has not been explained rationally; when flies follow animals or men they leave

(1) The most important have already been described in the original article by M. E. FALLON; see R. Feb., 1917, pp. 177-185. (Ed.)

them as soon as they pass the limits of the belt, outside which there is something inimical to the fly which is unknown to us. The author is convinced that animals play a small or no part in the mystery; he has often found the insect in swarms in regions containing extremely few animals, and he has not found it in regions with plenty of wild animals of all kinds.

The author considers it most dangerous to assume that wild animals are the chief reservoir of sleeping sickness, because a trypanosome sometimes found in them cannot be distinguished microscopically from the trypanosome known to cause the disease in man. The author thinks that the animals to be implicated in the transmission are pigs (wild and especially domesticated) and, in 1914, together with Dr. DUTTON, he noted (*Reports of the Liverpool School of Tropical Medicine, Sleeping Sickness Expedition to the Congo*) that *Glossina palpalis* was frequently seen in the ears of the pigs, often being thus carried considerable distances from the water. The author, wishing to obtain positive evidence for or against the theory, that wild animals were an important reservoir for sleeping sickness, has examined microscopically (as soon after death as possible) the blood of numerous animals. Out of 100 animals, including the giraffe, elephant, buffalo, dinkar, pig, colobus monkey, etc., only five were found to have trypanosomes in their blood, and only one, a wart-hog, out of all the number, had a species of trypanosome which might be mistaken for the human trypanosome. Many samples of buffalo blood were examined, but on no occasion were any trypanosomes found in them.

1321 - **Utilisation of the Serum of the Horse for Human Nutrition.**—J. INDET, L., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 29, pp. 507-510. Paris, October 2, 1918.

It has occurred to M. CESARI ("Vétérinaire-major") that, in war time when no part of an animal fit for food should be neglected, there would be no objection to the substitution of albumin from horse's blood for white of egg in cooking. The blood of the horse contains 8 % of coagulable albumin and white of egg 10 %.

The author describes tests made under the direction of Lieutenant G. LACOUR.

The method followed was to collect the blood under very clean conditions, to extract the fibrin by beating, then leaving to stand to allow the globules to settle. The settling takes place more quickly with blood of the horse than that of the cow, sheep, etc. Settling could be hastened and the serum increased by centrifugalisation.

The author and those present at the tests tasted various dishes in which the serum replaced white of egg (omelettes, rice cake, waffles, etc.) and which were pronounced very good.

The difference in price between horse serum and white of egg is enormous: the blood of a horse fetches about 2d., for which price 20 litres of blood or at least 10 litres of serum are obtained. Supposing that it costs 9 1/2 d. or even 1s. 6 d. with the treatment, even then the 10 litres of serum will replace the whites of 200 eggs; if it is admitted that the white is only one-third the value of the egg, the whites of 200 eggs are worth at least 24s.

1322 — **On the Appearance of the Antiscorbutic Substance during the Germination of Seeds.** — WEILL, E., MOURIQUAND, G. and MIE, PÉRONNET, in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, pp. 607-610. Paris, June 8, 1918.

The authors have found that, contrary to the theories of FURST (1), seeds (oats, barley) during germination (3 days) have no antiscorbutic power whatever as regards the nutrition of the guinea-pig, as such animals fed on germinated seeds showed more intense scorbutic lesions than those fed on dried grains, probably on account of their prolonged survival. This power should appear later, during the development of the plant. Thus, a guinea-pig given a mixture of barley germinated for 3 days and barley germinated for 10 days (grass) showed normal health and growth after 200 days of experiment.

On the contrary, however, these germinated seeds gave the animal a survival that was double, triple or quadruple that given by dried seeds, or reasons most of which remain to be ascertained.

1323 — **Organisation of Public Professional Teaching of Agriculture, in France.** — I. *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 33, pp. 1-3, Paris, August 13, 1918. — II. *Bulletin de la Société des Agriculteurs de France*, pp. 197-200, Paris, August, 1918.

AGRICULTURAL EDUCATION

The new French law of August 2, 1918, on the organisation of public professional teaching of agriculture in France, is intended, according to M. VIGER, who presented the law to the Senate, to provide agricultural education no longer for 2000 youths and a few hundred girls, but for 1 million youths and 1 million girls.

1) **EDUCATION FOR YOUTHS.** — *Agriculture* is taught (art. 1): — 1) at the "Institut national agronomique", which is the normal higher school for agriculture; 2) at the National Schools of Agriculture of Grignon, Montpellier, Rennes; 3) in the schools of agriculture including a) schools of practical agriculture; b) the farm schools; f) the technical schools where some agricultural speciality is taught; 4) in the winter or seasonal schools of agriculture; 5) in the agricultural continuation courses.

Horticulture is taught: — 1) at the National Horticultural School at Versailles, which is the higher school for horticulture; 2) in the schools of horticulture as in section c (technical schools).

In order to give a thorough practical training to the pupils leaving the National Agronomic Institute wishing to take up an agricultural career or become professors of agriculture, practical schools will be founded on the estates of the National Schools of Agriculture, at Grignon, Montpellier and Rennes. These schools could also be attended by students from the national schools wishing to specialise and by free auditors (see art. 3 of the law). As regards the *practical schools*, owing to the bad results given by the way of running some of them as actual farms on which the director-farmer, obliged to make the greatest possible profit out of his farm, considers the students as labourers, in many cases, rather than real pupils.

(1) FURST. — *Zeitschrift für Hygiene und Infektionskrankheiten*, 1912, LXXII, p. 122.
(Authors' note).

the law provides that save in exceptional circumstances the farm shall be run either on behalf of a commune, a department, or the State (art. 10).

The really new part of this law is that tending to create and spread everywhere in France the winter or seasonal agricultural schools and public continuation agricultural education.

Art 14.—The *winter or seasonal agricultural schools* are fixed or travelling. They are designed to give, during the bad season, professional instruction to the sons of farmers who cannot spend 2 or 3 years in a professional school of agriculture. They are controlled by the Minister for Agriculture.

According to art. 20, *continuation agricultural instruction* can be given in public schools or in premises placed at the disposal of the State by the communes or private persons. In each commune, the course is started either on request of the municipal council, or on request of the departmental commission provided for in art. 23, and on a favourable report from the general Council. The course, according to art. 22. of the law, is paid for by the department.

II). EDUCATION FOR GIRLS.—Art. 26.—Instruction in agriculture and housewifery for girls is given:—

1) at the National Agronomic Institute ; 2) in the National Schools of Agriculture ; 3) in the agricultural housewifery schools, which may be fixed, temporarily fixed or temporarily travelling and which will be known as "*Ecoles agricoles ménagères*", "*Ecole agricoles ménagères temporaires*", and "*Ecole agricoles ménagères ambulantes*" ; 4) in the course of continuation instruction in agricultural housewifery.

The conditions under which the new law is to be applied will be fixed by the rules of public administration.

1324.—High Council of Agricultural Stations and Laboratories, in France.---*Journal Officiel de la République Française*, Year L., No. 222, p. 730. Paris, August 16-17, 1918.

An order of the Minister of Agriculture, dated August 12, 1918, constituted a High Council of Agricultural Stations and Laboratories composed of 25 members, 9 of which are elected by the "*Académie des Sciences*", 6 by the High Council from competent persons of note, and finally 4, representing the Minister of Agriculture, are named by him. The members are appointed for 3 years and one-third will be relected each year; they are eligible for reelection. The General Inspector of Agricultural Laboratories will be present at the meetings for purposes of consultation. The Council has to watch over the working of the agricultural Stations and Laboratories, to guide and direct them in the path assigned to them so as to make them as highly useful as is possible. It treats with all questions relating to scientific researches to be undertaken and to be carried on in those establishments.

1325.—Recent Investigations at the Imperial Institute, London. (1)—*Bulletin of the Imperial Institute*, Vol. XV, No. 4, pp. 465-503, 544-568. London, October-December, 1917.

UTILISATION OF STALKS OF FLAX CULTIVATED FOR SEED.---As a res-

(1) See R. Oct., 1918, No. 1075. (Ed.)

the stalks of flax from which the seed has been removed are burnt. This is the best way of utilising small quantities as the ash can be applied as fertiliser. When, however, as in Argentina, the United States, and Canada, flax is grown on a large scale, other possibilities should be considered. At present there are two such possibilities: — 1) production of tow from the stalks; 2) the manufacture of paper pulp or paper. Both these methods demand expensive equipment and can only be adopted where there is a large quantity of raw material and a local market for the final product, which is not sufficiently valuable to export. In Rhodesia the cultivation of flax as an oil-yielding plant is rapidly increasing, and the British South Africa Company sent to the Imperial Institute a sample of flax stalks for information as to the methods of utilising them. The sample contained 11.1% of moisture and 3.6% of ash. The fibres extracted were from 12 to 25 mm. long. Treatment with caustic soda gave 44% of strong paper which did not bleach easily. Treatment with sulphite gave 45 and 46% of paper which bleached without difficulty. By crushing between rollers, beating and threshing, about 23% of tow suitable for paper-making was obtained. When treated with caustic soda the tow yielded 50% of paper but little superior to that obtained from the whole stalks. The shive when treated with caustic soda gave 43% of pulp which did not bleach and could only be utilised if mixed with longer-fibred material or for making very common paper.

PRODUCTION OF SISAL HEMP. — Samples from South Africa, British Honduras, and the Belgian Congo gave on analysis the following results: — Moisture, 8.2, 10.1, 9.5%; percentages on dry fibre basis. — Ash, 1.6, 0.7, 1.1; loss on α -hydrolysis, 9.3, 11.3, 14.8; loss on β -hydrolysis, 10.8, 13.6, 15.9; loss on acid purification, 1.3, 2.3, 2.2; loss on washing in water, 1.3, 2.6, 2.0; cellulose, 79.2, 76.7, 74.8. The first two were of good quality, the third less so.

FIBRES FROM THE BEIGIAN CONGO (1). — Besides the Sisal hemp (*Agave rigidula* var. *sisalana*) mentioned above fibre of the following plants was examined: — Bowstring hemp (*Sansevieria cylindrica* and *S. guineensis*), Mauritius hemp (*Furcroea gigantea*), Manila hemp (*Musa textilis*), ramie (*Manniphyton africanum*, *Boehmeria nivea*), and *Aronga saccharifera*. On analysis the first four gave the following percentages respectively: — Moisture, 8.5, 9.2, 8.45, 8.5; on dry fibre basis: — Ash, 0.4, 0.9, 0.75, 0.9; loss on α -hydrolysis, 9.0, 10.4, 11.35, 11.8; loss on β -hydrolysis, 13.0, 13.7, 15.75, 21.0; loss on acid purification, 1.1, 2.0, 1.15, 2.4; loss on washing in water, 1.1, 0.4, 0.9, 1.8; cellulose, 74.0, 76.5, 77.4, 75.0 (the figures for *Furcroea gigantea* are the averages of two samples). Bowstring hemp is obtained from several species of *Sansevieria*, chiefly from *S. Ehrenbergii* of East Africa, *S. guineensis* of West and East Africa and *S. cylindrica*, found from Zanzibar to Angola. The fibre is used for cordage. *Manniphyton africanum* is an Euphorbiaceae confined to tropical West

(1) For other fibres of the Belgian Congo previously examined see R. Feb., 1917, No 118. (Ed.)

Africa. The bark is utilized by the natives of the Belgian Congo (where the plant is known as "N'kossa") for the extraction of a strong fibre used for making fishing lines. The samples examined were considered suitable only for making strong, but very coarse ropes. By degumming with dilute alkaline solutions a clean, fine, but weak fibre is obtained. *Arenga saccharifera*, or sago palm, is commonly cultivated in India, chiefly as a source of palm wine and sugar, and has been introduced into most tropical countries. From the base of the petiole is obtained a black fibre known as "ejow" or "eju", much used in the East. Three qualities are prepared: — 1) coarse, for brush making, 2) medium, for rope-making, 3) fine, for stuffing cushions and as tinder. The samples from the Belgian Congo were judged of good quality as material for stuffing, brushes, etc.

PRODUCTION OF OIL-YIELDING SEEDS FROM RHODESIA. — The production of oil seeds promises to become an important industry in Rhodesia. The only oil seeds at present produced on a commercial scale are peanuts and sunflower seeds, but experiments made at the Salisbury Agricultural Experiment Station have shown that other oil seeds, including linseed, sesame, niger seed and *Madia sativa* (locally known as Chile Oil seed), may be grown successfully. The cultivation of peanuts is steadily increasing as a result of the introduction of improved varieties by the Department of Agriculture. The exportation of sunflower seeds promises to become important. Peanuts and castor-seeds are grown by the natives in some parts of the country and the oil extracted for local use. Various oil seeds are being grown at the Government Experimental Gardens at Mazabuka and Chilanga, North Rhodesia. Samples of seed sent from these gardens to the Imperial Institute for examination gave the following yields in oil (on a dry seed basis): — Red Zanzibar Castor bean (*Ricinus sanguineus Zanzibaris*), 51.1%; black sunflower, whole seed 27.5%, kernel 49.1%; striped Russian sunflower, whole seed 21.5%, kernel 48.8%; sesame, 53.1%; white flowering linseed, 34.7%; Pskoff linseed 35.9%.

NEW PALM NUT FROM COLOMBIA. — The sample examined at the Imperial Institute was sent from the Tropical Agricultural Station, San Lorenzo, Colombia. Two varieties of the palm are very common in the Magdalena valley, one with large fruit, found in the lower valley, where it is known as "coroza", one with smaller fruit, found in the higher valley, where it is known as "quesco". The sample examined belonged to the first variety and appears to belong to *Scheelea excelsa* Karst. (= *Attalea excelsa* Mart.). The fruit consists of two or three nuts in a hard shell. The kernel, which is difficult to remove, contains 4% of moisture and yields 65.4% of fat melting at 29° C. In appearance the fat is similar to that of several kinds of palm (palm kernel and coconut oils), but differs from them in chemical characters (low saponification value, 224.6; high iodine value 35.2%; relatively small quantity of volatile acids, 2.1% soluble and 3.0% insoluble). The oil of these nuts is much valued in the tropical parts of Colombia, where it is used for cooking, burning, soap-making, as a lubricant and as a medicine.

WATTLE BARK AND WOOD. — Before the war the British market obtained much tanning material from the Continent; this market being closed,

attention was turned to the large supplies of wattle bark in South Africa, and the manufacture of wattle bark extract was undertaken in South Africa as well as in the United Kingdom; 6 505 tons of the bark were shipped direct from Natal to Russia in 1916. Wattle barks are derived from various species of *Acacia*, indigenous to Australia and introduced into South and East Africa, where they are grown in plantations. The best known as a tanning material in Europe is the bark of the black wattle (*Acacia decurrens* var. *mollissima*). The production of wattle bark is a very important industry in South Africa, especially in Natal, and it is rapidly growing. In 1916, there were about 160 000 acres under wattle in Natal; the exports of chopped bark from South Africa rose to 50 867 tons with an average price of £13 10s per ton. The chief sources of the Australian bark are the golden or broad-leaved wattle (*A. pycnantha*) and the black wattle (*A. decurrens* var. *mollissima*). In the East Africa Protectorate there are about 12 000 acres of wattle.

Commercial wattle bark contains an average of 32 % of tannin. Material remaining after being used for tanning or preparing the extract can be used for the production of paper; the wood can be used either for dry distillation or paper making. In experiments made at the Imperial Institute spent wattle bark (containing 11.5 % of moisture, 41.2 % of cellulose and 8.7 % of ash) yielded, according to the treatment, from 28 to 35% of dry unbleached paper pulp. Commercial tests in a paper works gave from 28 to 30 % of pulp quite suitable for making brown paper.

Wattle wood yields 61 % of cellulose (expressed on the dry material) and gives from 46 to 50 % of pulp which is lacking in strength owing to the shortness of the fibres. The pulp might be used for making "straw-board" especially if mixed with equal parts of spent wattle bark.

THE PRODUCTION OF TURPENTINE OIL AND ROSIN IN INDIA. — Turpentine-yielding trees are common in the forests of the Himalayas, in the United Provinces, in Assam, Burma and the Punjab. The oil and rosin extracted are used locally, but the quantity produced does not suffice. The chief source of Indian rosin is the Chir pine (*Pinus longifolia* Roxb.) which must be distinguished from the American *P. longifolia* Salisb., now usually known as *P. palustris* Miller. The latter is the longleaf pine of the Southern United States, and is the chief source of American turpentine oil and rosin. Five species of pine are indigenous to India: — *P. longifolia* Roxb (Chir pine), occurring in the Outer Himalaya and Swalik Range; *P. excelsa* Wall., (Kail or blue pine), occurring in the temperate Himalayas; *P. Khasya* Royle (dingsa or khasia pine), occurring in the Khasi hills, in Assam and Burma; *P. Merkusii* Jungl. and de Vriese (tinyu pine), of Burma; *P. Gerardiana* Wall. (Neosia or Himalayan edible pine) on the inner dry and arid West Himalayas. *P. longifolia* is the most important species in India for the commercial production of turpentine and rosin, smaller amounts being derived from *P. excelsa* and *P. Khasya*. *P. longifolia* is gregarious over about 2 068 530 acres, but it is tapped only in the Kumaon Division of the United Provinces and in Rawalpindi, Punjab. *P. excelsa* occupies about 65 000 acres in the United Provinces and the Punjab. *P. Kha-*

syia occupies an area of 33 sq. miles in Assam. Both in the United Provinces and in the Punjab, the tapping of the trees and the distillation of the oleoresin are conducted by the respective Forest Departments, whilst the sale of the turpentine and rosin is controlled by the manager of the distillery at Bhowali, in the United Provinces. In 1915-1916, in the United Provinces, 981,906 trees were tapped on 49,135 acres, giving 2,089 tons of crude oleoresin; the Bhowali distillery produced 1,285 tons of rosin and 80,390 gallons of turpentine. The Indian turpentine oil from *P. longifolia* yields practically no distillate below 165°C., and for this is quite different from American turpentine oil, which should yield not less than 70% by volume between 155° and 160°C.; it most nearly resembles Russian turpentine oil. *P. longifolia* oil distilled above 175°C contains 25-33% of *l*-terpene boiling at 173°; the large proportion of this constituent renders the Indian oil inferior to the best French and American turpentine oils, which consist almost wholly of pinene boiling at 156°C. Indian turpentine oil can be used, however, like the other varieties.

COPAL FROM COLUMBIA. — The Imperial Institute has examined a sample of copal sent by the Director of the tropical Agriculture Station, San Lorenzo, Colombia. The copal is known locally as "ambara" or "algarrovido" and before the war, was exported to some extent to Germany. The sample submitted was of good quality and has the following characteristics: — moisture, 0.52%; ash, 0.09%; melting point, 123°C.; acid value, 100.8; saponification value, 103.6; loss on melting, 18.0%.

TOBACCO FROM NYASALAND AND UGANDA. — In 1916-17 there were 7,484 acres under tobacco, in Nyasaland, giving an export of 4,304,124 lb., besides quantities stored. Three sets of samples, grown and prepared on the Government Farm at Namiwawa, Nyasaland, and illustrating a) the results of topping experiments, b) of manuring tests, and c) grades of tobacco forwarded to London for sale, were examined by the Imperial Institute.

a) The 9 samples of "Gold Leaf" tobacco, topped at different heights so as to mature from 7 to 15 leaves per plant, were very similar; it seems that, on the whole, higher topping, viz., to produce 14 to 15 leaves, is not disadvantageous.

b) The 6 samples of "Conqueror" tobacco were manured as follows: — 1) lime; 2) cattle manure; 3) cotton seed; 4) control; 5) lime and cattle manure; 6) lime and cotton seed. The effect of the different methods of manuring was not very marked; certain treatments, especially those with lime + an organic manure, produce a slightly stronger flavour due to the increase in the percentages of lime and nicotine. The burning properties were not noticeably altered by the manuring in any case.

c) The tobacco growers of Nyasaland grade their tobacco into two groups: — a) mahogany and dark leaves of heavy or good body, suitable for pipe and plug tobacco, and b) brighter and thinner leaves suitable for cigarette tobacco. Each group is further divided into commercial grades.

Tobacco is grown on a comparatively small scale in Uganda, mainly by the native for local consumption.

Samples of Virginia tobacco grown and cured on the Nambeya Estate.

Bulemezi, Mengo District, near Kampala, had a good chemical composition (moisture 14.0 %; nicotine 1.9 %; nitrogen 2.7 %; ash 18.7 %) with a low percentage of nitrogen and a large proportion of potash (the ash contained:—lime 26.0 %; magnesia 9.4 %; potash 34.6 %; soda 3.1 %; sulphuric anhydride 3.0 %; chlorine 1.9 %).

CROPS AND CULTIVATION.

1326 — The Question of Hail-roads and Storms in the Gironde, France, in 1918. —

ANGOT, A., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. IV, No. 30, pp. 838-849. Paris, October 9, 1918.

AGRIC.
METEO.

M. ANGOT has presented to the Academy a study, by M. COURTY, astrophomer to the Bordeaux Observatory, on the storms observed in 1917 in the Gironde and part of Dordogne, a region furnished with a large number of hail-roads ("niagaraux électriques").

In his report, M. COURTY gives a table showing the localities where hail-roads have been installed and the number of times that hail fell in these localities during the 6 years 1911-1917. In two localities the observations ended in 1916 at the same time as the Municipal Council requested the prefect to order the removal of the hail-road as they blamed it for the frequency with which hail had fallen since the hail-road had been set up. On the contrary, in two other localities no hail was observed during the six years.

M. COURTY simply gives the facts observed, without drawing conclusions, while expressing the wish that these observations should be continued. In fact, the irregular appearance of hail throws doubt on any conclusions that might be drawn from a small number of observations.

M. ANGOT supports M. COURTY's wish, as the results will be all the more searching as the period of observation is longer. The 5 years of observations made by the author of the study tend to confirm M. ANGOT's previous opinion: that hail-roads have no influence whatever on hail.

1327 — Relation between Climate and Cereal Yield in Sweden. — WALLÉN AXEL, in *Ymar*, Year XXXVIII, Pt. 1, pp. 1-23 + 2 Figs. + 2 Tables + Bibliography of 8 Publications. Stockholm, 1918.

The author has calculated for every province of Sweden the coefficient of correlation, r (1), between the monthly temperature, monthly rainfall and yield in grain of barley, oats, wheat and rye. Numerous graphs illustrate the figures clearly and maps show the lines of distribution of the values of r by province, thus making it possible to form a clear idea of the relation between the meteorological factors and agriculture in the different districts of Sweden.

WINTER CEREALS (WHEAT AND RYE). — In the coast districts of southern Sweden (Malmöhus, Kristianstad, Bäckinge, Gotland Island, the southern part of Kalmar, Halland) the maximum values of r with regard to temperature for wheat are: — November — 0.23; May — 0.21; January

(1) See *R. Feb.*, 1918, note to No. 148, p. 175. (*Ed.*)

$+ 0.28$; February $+ 0.26$. The summer values for r are low, but constantly negative. This is certainly due in part to the hot summer of 1901 which was very detrimental to the crops of the south which generally lacked rain.

The coefficient of correlation for precipitation is always very low, except in May, which has very high positive values: — Kalmar $+ 0.59$; Blekinge $+ 0.52$.

A temperate winter, cool and rainy May, and a moderately warm summer are necessary to obtain a good wheat harvest in the coastal districts of South Sweden. About the same conditions are necessary for rye.

As the north and interior of the country (Göteborg, Älvborg [the part south of Vänern], Jönköping, Kronoberg, the north of Kalmar) are approached the total temperature decreases gradually and the correlation coefficient for the summer months becomes positive, a hot summer being necessary to ensure ripening. For winter, on the other hand, the observations respecting the preceding zone hold good here as well — February $+ 0.22$, March $+ 0.24$, April $+ 0.23$. The gradual lowering of the temperature is accompanied by an increased rainfall which assures the plants the necessary amount of moisture for each stage of their growth. The result is that the relation between yield and precipitation tends to be still and the values for r are always very low.

The same conditions exist for rye, though the value for r expressing correlation between yield in grain and the temperature of November and December is in this case negative. In the provinces of Östergötland, Älvborg (to the west of Vänern), Sävleborg, and other provinces of Svealand, the lack of heat is still more marked. As a result, except for August and September, the correlation coefficient between temperature and yield for the vegetative period is always positive: — August $- 0.39$, September $- 0.21$, November $+ 0.21$, February $+ 0.26$, March and April $+ 0.25$. The values of r for rainfall are distinctly positive for August, September, April and May (sowing, appearance above ground, earing), and negative for June and July. For rye, unlike wheat, a temperate winter is disastrous. The value r is markedly negative in January and remains positive in February, but is almost negligible.

In the northern provinces of Jämtland, Västernorrland and Norrbotten, where only rye is grown, the coefficient of correlation of temperature is always positive, except in September, and the maximum values occur in April, May, and July, when they are $+ 0.41$, $+ 0.44$, and $+ 0.42$ respectively. For precipitation the values are: — October $+ 0.27$, June $+ 0.23$, August $- 0.48$.

The most striking facts deducted from these data are: —

- 1) The existence of a negative correlation coefficient between yield in grain and the temperature of August and September in northern and central Sweden and some parts of southern Sweden.
- 2) A negative r value for the temperature of November and December, especially in South Sweden.
- 3) A positive relation between the temperature of the winter months

and yield, the value of which decreases as the north is approached until it is reversed and becomes negative (Norrbotten, etc.).

4) The favourable influence of a cool, wet May in South Sweden.

5) In the northern provinces there is a positive correlation with the temperature of the summer months, i. e. the best crops are obtained after a hot summer. As the south is approached the ratio decreases with the increase of the total temperature till it is inverted, so that in some coastal districts of the extreme south with a low rainfall the best crops are obtained in cool, wet years.

SPRING CEREALS (BARLEY AND OATS). — The values for the provinces of Malmöhus, Kristianstad, Blekinge, South Kalmar and Halland are:—

| | |
|---------------|--|
| Temperature | $\left\{ \begin{array}{l} \text{Barley: May} = 0.23, \text{June} = -0.42 \\ \text{Oats: May} = 0.24, \text{June} = -0.49, \text{August} = 0.15. \end{array} \right.$ |
| Precipitation | $\left\{ \begin{array}{l} \text{Barley: May} + 0.22 \\ \text{Oats: May} + 0.29, \text{June} + 0.32. \end{array} \right.$ |

In the other provinces of South Sweden, unlike the preceding case, the temperature values for r are positive during all the months except June and July. In Central Sweden the temperature values for barley and oats are positive in March, April and August, and negative in May, June, and especially in July ($r = -0.31$). Except in August the value of r for rainfall is always positive:—

$$\begin{aligned} \text{Barley: May} &+ 0.21; \text{June} = 0.23; \text{July} + 0.28 \\ \text{Oats: May} &+ 0.35; \text{June} + 0.34; \text{July} + 0.35. \end{aligned}$$

The best barley and oat crops, therefore, are obtained in wet years. As the north is approached rainfall becomes more and more abundant so that the relation between rainfall and grain yield tends to disappear while the effect of temperature becomes more and more marked, the correlation coefficient becoming positive for every month without exception, the maximum value — *Barley* + 0.38, *Oats* + 0.40 — occurring in June. It may be concluded that the most important meteorological factor for spring cereals is precipitation in Central and South Sweden (especially the May and June rains), and temperature in North Sweden.

FORECASTING THE YIELD. — The use of the correlation coefficient makes it possible to forecast the yield of a future crop within certain limits which are all the more certain as the value of r is higher. Thus, for example, in the province of Malmöhus, the author was able to determine the following coefficients of regression (1) for winter cereals:—

1) For each degree of the average temperature of August above the normal, the yield in grain *decreases* by 0.18.

2) For each degree of the average temperature of November and December above the normal, the yield *decreases* by 0.50.

3) For each degree of the average temperature of January and February above the normal, the yield *increases* by 0.14.

(1) See *R.* March, 1918, note to No. 270, p. 315. (Ed.)

4) For each 10 mm. of rainfall above the normal in October and November, the yield decreases by 0.06.

In 1916-17 the average temperature of August exceeded the normal by 0.2°, that of November and December exceeded it by 1.6°, but that of January and February was 1.7° below the normal. The rainfall for October and November was 30 mm. above the average. If the figures given above be applied a total decrease in yield is found which may be expressed by 1.3 (coefficient of regression). The author gives several other such examples, all of which show the practical value of the coefficient of correlation in forecasting the harvest.

1328 - **The Effect of Temperature and other Meteorological Factors on the Growth of Sorghum.** — VINALL, H. N. and REED, H. R., in the *Journal of Agricultural Research*, Vol. XIII, No. 2, pp. 133-147 + 2 Plates. Washington, April 8, 1918.

The varieties of sorghum studied were Sumac, Red Amber, Honey, Blackhull Kafir, Dwarf Milo and Feterita, and the meteorological observations were made at Chillicothe (Texas), Chula Vista and Bard (California), and Puyallup (Washington), stations having widely different climatic conditions. The contrast between the last two is very marked, Bard having a high temperature and a high percentage of sunshine during summer, whereas the maximum temperature at Puyallup does not reach the optimum temperature for sorghum (33° C.). These conditions greatly influence the growth of the plant. The data collected from 1915 to 1916 lead to the following conclusions: —

1) *Sorghum is a plant specially adapted to tropical and semi-tropical climates and cannot thrive in cold regions.* — At Chillicothe and Bard, where the average temperature during the vegetative period is 25.8° C. and 28.2° respectively, sorghum does very well and ripens in 106 and 129 days after sowing, reaching an average height of 68 and 82 inches and a stem diameter of 0.79 and 0.68 inches. At Chula Vista, where the average temperature is much lower (18.2° C.), the grain ripens a month late (average date for the six varieties of sorghum; November 14), and the vegetative period lasts 141 days. At Puyallup, with a temperature of 15.3° C., sorghum does not ripen, so that it may be considered outside the sorghum belt. The difference between the total positive temperature (i. e. above 19° C.) during the vegetative period — 1052° C. at Chula Vista and 897° C. at Puyallup — is very small, and not sufficient to explain the different behaviour of the plant in the two localities. Another meteorological factor, the amount of sunshine is concerned in this.

2) *Application of LINSSER's law to sorghum.* — The total positive temperature is 1052° C. at Chula Vista, 2353° at Bard, 1682° at Chillicothe. According to LINSSER the amount of heat required for the development of a certain stage is not the same in all parts of the area of distribution of a plant but increases with the annual total of positive temperatures. By dividing the total positive temperatures for the vegetative period by the annual total the "physiological constant" is obtained. If this law be applied in the present case the physiological constant is about 0.53 (Chillicothe 0.53; Bard 0.530, Chula Vista 0.526).

3) *Effect of sunlight.* — The percentage of sunshine at Puyallup (46.4) is much lower than that of the other stations, especially that at Chula Vista (68.4). Besides lowering the temperature, a low percentage of sunshine helps to lengthen the vegetative period till it may, as at Puyallup, prevent ripening altogether.

4) *Effect of high temperature on flowering and the formation and ripening of seeds.* — High temperatures at the beginning of flowering are detrimental to the plant and decrease the yield considerably. In 1915 the seed was sown in April so that flowering and fruiting occurred in the middle of summer, at high temperatures, and the yield in grain was low. In 1916 sowing was in mid-June and flowering and fruiting at the end of summer and in autumn respectively, when the temperature was much lower, and a good yield was obtained. Sowing should be timed so that flowering and fruiting will take place under favourable climatic conditions.

1329 — *The Influence of Rainfall on the Fruit Crop in Norway.* — SKARD, A. M., in the *Tidsskrift for det Norske Landbruk*, Year XXV, Part. 8, pp. 305-332. Christiania, 1918.

Apples and pears can be successfully grown in the following regions of Norway: — North Bergenshus, Jarlsberg and Larvik, Nedenes, Smaalnæ, Lister and Mandal, Buskerud, Stavanger, Heddmarken, Akershus, Bratsberg, South Bergenshus, Kristians, Romsdal, South and North Trondhjem.

The average crops from 1907-1916 were sufficient for local needs. But there is the serious disadvantage, that the crop varies greatly year by year, thus largely exposing the market to foreign competition. Thus, taking the average crop as 100 we get: — in the Buskerud, 125 % in 1909 and 41 % in 1916; at Lier, 150 % in 1909-11 and only 30 % in 1916; in Balestrand, 150 % in 1911 and 70 % in 1916.

Thus there are years in which the supply exceeds the demand and others when the supply is completely insufficient. To avoid these difficulties, the factors of the variations given above must be known and, given that these variations persist while the conditions of soil and crop remain unchanged, it is obvious that the primary cause of the phenomenon must be sought in the weather conditions.

The author gives the results of a series of researches on the relationship between the yield in fruit and the rainfall. The following localities (centres of production) were studied: — Faaberg, Furnes, Edsvold, Væstre Aker, Rygge and Moss, and Norderhov, all situated in south-eastern Norway (Åslandet).

From the examination of abundant observations it was concluded: — 1) that there is a direct ratio, a positive correlation, between the crop-yield and the rainfall from March to June of the previous year; 2) that there is an inverse ratio, a negative correlation, between the crop-yield and the rainfall of September-October of the previous year. In spring the plant requires a large amount of plastic material so as to satisfy the needs of intense and quick growth: — leafing, flowering, setting, formation of flower buds for the following year. The absorption of material from the soil is subor-

defined to the presence of water in sufficient amount to dissolve and carry such material.

Insufficient moisture at this moment is fatal to the plant; part of the very young fruit becomes detached on account of lack of food material, and the next year's fruit buds develop badly or incompletely, resulting in a poor spring flowering. From this it will be seen that there is a positive correlation between the fruit crop and the total rainfall from March to June.

During the second half of summer and the beginning of autumn, dry, warm weather is required to mature the spring wood, the fruit, the fruit buds, and the store of reserve materials necessary for recommencing growth in the following spring. When this period is damp and rainy growth continues longer, to the detriment of the reserve material. As a result there is a) *incomplete maturity of the buds and wood and also, in consequence, decreased resistance to cold*; b) *an insufficient store of reserve materials and, in consequence, limited and poor flowering in spring*.

There is, therefore, a negative correlation between the fruit crop and the total rainfall from September to October. Below are given the data for the Faaberg region, the rainfall data being taken from the nearest meteorological station, that at Lillehammer.

Data showing the existence of a ratio between the fruit crop and the total rainfall for the periods March-June and September-October (average rainfall: March-June 169 mm; September-October, 125 mm).

| Years | Yield in % of the average | Rainfall | | |
|-------|---------------------------------|----------|------------|-------------------|
| | | Years | March-June | September-October |
| 1909 | 159 % | 1909 | 138 mm | 48 mm |
| 1911 | 130 | 1910 | 200 | 56 |
| 1914 | 120 | 1913 | 142 | 42 |
| 1913 | 115 | 1912 | 178 | 119 |
| 1915 | 80 | 1914 | 175 | 67 |
| 1907 | 49 | 1909 | 157 | 113 |
| 1908 | 25 | 1907 | 238 | 135 |
| 1910 | 20 | 1909 | 171 | 100 |
| 1912 | 39 | 1911 | 145 | 131 |
| 1916 | 20 | 1915 | 71 | 39 |

There are similar conditions in other localities. A good crop does not always correspond to abundant spring rain or too little summer-autumn rain. The number of flowers does not mean a corresponding number of fruits; the action of late frosts at the moment of flowering and mists during setting may ruin the crop, even though flowering has been most abundant. This explains the variations in the above Table. As the north and west are gradually approached, with the increase of the total rainfall during all the

year, the ratio existing between the rain and the fruit crop disappears, whilst the action of other factors and weather conditions is plainly shown.

On account of the preponderating action of the rainfall the author gives the following advice to fruit growers in Östlandet: —

- 1) Choose varieties very resistant to drought.
- 2) Work the soil deeply so that the plant's roots can grow in length, thus utilising the water stored in the deep layers.
- 3) Give the preference, as intercrops, to potatoes, leguminous plants, carrots, etc. These plants have, at any rate in Norway, only a limited growth up to mid-June and thus only remove a limited quantity of water from the soil. During summer, on the contrary, and at the beginning of autumn, the foliage increases rapidly owing to the absorption of large quantities of water, of which the fruit trees are deprived with advantage.

1330 — **Influence of Nutritive Salts on the Resistance of Plants to Cold.** — See No. 1330 of this *Review*.

1331 — **Recent Investigations on Soil Aeration.** — I. HALL, A. D., *Phil. Trans., B.*, 204, 1913. — II. HUNTER, C., *Proc. of the Univ. of Durham Phil. Soc.*, IV, p. 183. — III. HOWARD, A., *Agr. Research Institute, Pusa, Bulletin* 61, 1916. — IV. RUSSELL, E. J., and APPLEYARD, A., *Jour. of Agr. Sc.*, VII, p. 1, 1915. — V. HOWARD, A. and HOWARD, G. I. C. *Fruit Experiment Station, Quetta, Bulletin* 4, 1915. — VI. *Annual Report of the Imperial Economic Botanist*, 1916-17. — VII. RUSSELL, E. J. and APPLEYARD, A., *J. of Agr. Sc.*, VIII, p. 383, 1917. — VIII. *Agr. J. of India, Science Congress Number*, p. 26, 1917. — IX. CAXTON, W. A. and FREE, E. E., *Journal of Ecology*, V, p. 127, 1917. — X. HOLE, R. S., *Ind. For. Mem.*, I, p. 46, 1911. — XI. *Id. Indian Forester*, p. 343-344, 1916. — XII. *in. Indian Forest Record*, V, p. 38, 1914. — *Abstract* by HOWARD, A. (Imperial Economic Botanist) and HOLE, R. S. (Imperial Forest Botanist), *Indian Science Congress, Lahore, 1918* (1).

The growth of a crop is only possible through the simultaneous operation of a number of soil factors — water, mineral salts, temperature and oxygen. If any one factor is in defect, or in excess as in the case of temperature, growth is regulated by the amount of this factor present, and is not influenced by an increase in any of the other factors. The chief object in soil management is the removal, in advance, of any possible limiting factor.

The aeration of the soil is a factor in growth which has been neglected in the past. It has only indirectly been recognised in the importance attached to a proper soil texture. The subject is not attracting more attention and it is proposed to refer to some of the recent work and to indicate the directions in which further investigation is desirable.

AERATION AND THE AMOUNT OF GROWTH. — Various determinations have been made of the amount of growth in cultures in which the only variable factor is the degree of aeration.

1) *The effect of increased aeration on the root development of barley.* — In water cultures, HALL (I) found that both root development and growth depend on the amount of aeration.

(i) See *R.*, 1914, No. 12; 1915, No. 571; 1917, Nos. 790 and 795. (Ed.)

2) *The effect of soil texture on growth.* — HUNTER (II) found that root development and growth fell off as the soil was more consolidated.

3) *The effect of adding potsherds or sand to the Pusa soil (III).* — The addition of inert aerating agents like sand, potsherds or broken bricks to Pusa soil (a fine calcareous silt which readily loses its texture) increases the growth very markedly. In the case of Java indigo, where both nitrogen and oxygen are required, the increase is as high as 40 %. To follow the subject further, the structure of the soil must be considered in relation to the root development of the plant. The pore spaces of the soil are taken up by air and water, the latter occurring in thin films round the soil particles. The biological activities of the root hairs and of the soil bacteria involve respiration for which a constant supply of oxygen is necessary and which results in a continuous production of carbon dioxide. Efficient soil ventilation is therefore essential for growth. Recent investigations at Rothamsted (IV) on the composition of the soil atmosphere show that the amount of oxygen in the soil falls as the amount of carbon dioxide rises. The water films contain little oxygen but much carbon dioxide, that is, the oxygen is used up as rapidly as it is supplied.

VENTILATION OF THE SOIL AND THE SYSTEM OF FLOOD IRRIGATION IN NORTHERN INDIA. — Flood irrigation on fine alluvial soils interferes with their ventilation by rapidly destroying the texture and by forming a compact surface crust impermeable to air. One limiting factor — water — is removed but another — the need of aeration — is introduced. Thus over-irrigation actually diminishes the yield. This is shown by results obtained at Quetta where 13 maunds of wheat were obtained with one irrigation and only 8 maunds where three irrigations were given. In any flood irrigation system, a practical compromise between the needs of the plant for air and for water must be worked out. This has been accomplished at Quetta (V) by the proper utilisation of the preliminary watering given before sowing. Under this new system, the yields obtained are often higher than those obtained with the 6 or 7 waterings usually applied. The Quetta results have been shown by experiment to apply to the Punjab (VI) and Sind where almost half the irrigation water now used could be saved. The economic significance of these results becomes apparent when it is remembered that the annual revenue derived from irrigation works in India is £ 5 000 000.

SOIL AERATION AND QUALITY. — It is well known that the quality of vegetable products varies with the locality, but the factors on which quality depends are still undetermined. Breed is undoubtedly one of the most important, and no improvement in cultivation can change a short-stapled cotton into a longstapled kind. Various observations suggest that for each variety to attain its highest quality, adequate soil aeration is necessary. A few examples may be given: —

1) *Barley* — The best malting samples are always grown on open well-aerated soils and never on stiff heavy clays.

2) *Tobacco* — All the tracts in India which have achieved a reputation for the production of tobacco of good quality are those in which aeration is above the average.

3) *Cotton* — Mr. CLOUSTON's results on the open laterite soils at Chandkhuri indicate that soil aeration is one of the factors on which the quality of the staple of cotton depends.

Experience in India shows that crops will not mature properly if soil aeration is interfered with during the ripening period. Recent results obtained at Rothamsted (VII) shew that, on cropped land, ripening is associated with a great outpouring of carbon dioxide into the soil atmosphere. The cause of this is not known. It has been suggested that it is due to the death and decay of the fine roots after the flowering period, but this will not explain the observed delay in ripening if air is not supplied during the period of maturation. An interesting field of research lies ready to hand.

OTHER ASPECTS OF SOIL AERATION. — If soil aeration is a growth factor, aeration must influence the distribution of plants, as of grain in India (VIII), and be of importance in ecological studies. CANNON in Arizona and FREE (IX) of the Johns Hopkins University have shown that the poor conditions of soil aeration are correlated with the absence of vegetation in the dry lakes of desert basins, and the zonation of vegetation round these basins may be in correlation with the soil aeration requirements of the plants involved.

The importance of soil aeration in Indian forestry (X, XI, XII) has recently been emphasised by a study of the factors influencing the healthy growth of sal (*Shorea robusta*) seedlings. Whereas water cultures have shown that water in itself is quite harmless, yet water which is held in contact with sal forest soil rapidly becomes highly injurious to the roots of the seedlings. Any factor which increases the amount of moisture in the soil, such as shade or bad drainage, accentuates the injurious action. Rain-water held in contact with such soil is found to become heavily charged with carbon dioxide and impoverished as regards its oxygen supply. In water culture experiments, a high carbon dioxide and low oxygen-content have been proved to be injurious to the roots. There are good grounds for believing that, in addition to sal, many of the most important Indian trees are very sensitive to soil-aeration, and a careful study of this factor appears to be of primary importance in Indian forestry not only on account of its effect on the establishment and development of seedlings but also because of its probable influence on the growth of older trees and its possible connection with injurious diseases.

1332 — *Copper and Zinc as Antagonistic Agents to the "Alkali" Salts in Soils.* — LIPMAN, C. B. and GERICKE, W. F., in the *American Journal of Botany*, Vol. V, No. 4, pp. 151-170 + 13 Tables + Bibliography of 11 Publications. Lancaster, Pa., April, 1918.

The antagonistic salt effect is now regarded as one of the established facts in plant physiology as in animal physiology. In the large amount of work done on the antagonism between salts, the heavy metals have received very little attention, while the alkali and alkali-earth metals have been tested in many ways. The authors consider the chief work on the heavy

metals (LOEB (1), CLARK, TRUE (2) and GIES, HAWKINS, LILLIE, etc.) and remark on the negative results obtained with copper and the lack of data, as far as regards the more important functions of plants, on the antagonistic action of that metal to the alkalies. As the authors had observed the stimulating effect of copper and zinc in certain cultures, they undertook to study the antagonistic action of copper (and of zinc, whose stimulating effect seems to indicate a similar method of action) to the toxic effects of "alkali" salts as regards the living cells of higher plants (3).

The plants used as indicators were a strain of barley (*Hordeum vulgare*). They were sown in pots and optimum and uniform moisture conditions were maintained in the soils. Some of the common salts of alkali soils, viz. chloride, sulphate and carbonate of sodium, were used as toxic agents, being added on a percentage basis of the dry weight of the soils. The antagonistic agents were the chlorides and sulphates of copper and zinc and copper carbonate, added to the salt-treated soils in quantities varying between certain limits (parts per million of dry soil). Two types of soil were employed, one sand, the other clay. The plants were grown to maturity, harvested, dried at 100°C., and weighed; the roots, stem and grain were weighed separately. The results were assembled in table form for each of the 7 series of cultures (including respectively: CuSO_4 versus Na_2SO_4 ; CuCl_2 versus NaCl ; CuCO_3 versus Na_2CO_3 ; Zn SO_4 versus Na_2SO_4 ; Zn Cl_2 versus NaCl ; Zn SO_4 versus NaCl ; CuSO_4 versus Na_2SO_4).

The authors state, without qualification, that the data they have thus obtained are the first evidence ever published of the antagonistic action between heavy metals and alkali salts. The antagonistic action is equally if not more marked when 4 ions are introduced into the soil, as in the case of the CuSO_4 versus NaCl culture. Although only one crop was grown in sand, the majority being in clay, similar evidences of marked antagonism were noted.

The authors call attention to the importance of these results from the point of view of their possible practical application, an application that is also economic owing to the small quantities of the metals required to antagonise large quantities of alkali salts and, seeing that zinc is almost as effective as copper in the direction noted, this fact may indicate possibilities in the same line with other and cheaper metals.

1333 - **The Effect of Heat on some Nitrogenous Constituents of Soil.** — POTTER, R. S. and SNYDER, R. S. (Department of Soil Chemistry, Iowa Agricultural Experiment Station), in *Soil Science*, Vol. V, No. 3, pp. 167-223 + 4 Figs. + Bibliography of 17 publications. Baltimore, March, 1918.

In investigations on the effect of heat on the nitrogenous constituents of soil only the ammoniacal and nitric nitrogen are usually estimated. The authors estimated the amino-acid nitrogen and soluble non-protein nitrogen as well. Three loam and one peat soils were subjected to the following treat-

(1) See *R.*, Feb. 1915, No. 155; — (2) See *R.* Oct. 1915, No. 1020 (*Ed.*).

(3) For the limits of the tolerance of plant life for sodium salts contained in the soil, see *R.*, Feb., 1917, No. 132. (*Ed.*)

ments:—*a*) Two hours' dry heat at 100°C., *b*) two hours' dry heat at 200°C., *c*) heating in the autoclave for 3 hours; *d*) heating in the autoclave for 3 hours on 3 successive days. In each case the soils were inoculated with fresh soil emulsion and left to incubate for 10 and for 20 weeks respectively. A control series was not inoculated.

Results.—In all soils subjected to heat the ammonia increased as the temperature was raised; in the peat soil heated to 200°C. excessive volatilisation of ammonia was observed. The amino-acid nitrogen gave results similar to those of ammonia except in the case of peat soils, which underwent very little change under the different treatments.

Dry heat at 100°C. modified very little the nitric nitrogen content of the soils, whereas heating in the autoclave increased it considerably in every case. Nitric nitrogen disappeared almost completely at 200°C. of dry heat. All treatments caused an increase of soluble non-protein nitrogen; this increase was less marked in the peat soil.

In the three loam soils incubation for 10 weeks after treatment with dry heat at 200°C. caused an increase in ammonia. In two cases incubation for 20 weeks also caused an increase in ammonia, but to a lesser extent than incubation for 10 weeks; in one case it decreased the ammonia. Incubation had very little effect on the ammonia content of peat soil subjected to dry heat.

Ten weeks' incubation always caused a decrease of amino-acid nitrogen, but a further ten weeks' incubation increased it. Nitric nitrogen increased during both periods of incubation. The soluble non-protein nitrogen in peat soil always decreased during incubation, but increased in loam soils heated to 200°C.

1334.—Studies on the Correlation between the Production of Carbon Dioxide and the Accumulation of Ammonia by Soil Organisms.—NELLER, J. R. (Dept. of Soil Chemistry and Bacteriology, New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. V, No. 3, pp. 225-239 + 5 Figs. + Bibliography of 14 Publications, Baltimore, March, 1918.

As the decomposition of organic matter in soil is generally a biological process, it is measured by various indices of biological activity, the most common of which are plate-counting, ammonification and nitrification. Ammonia determinations being the easiest and supplying much data, the author studied the relation between ammonia accumulation and carbon dioxide production, between which there appears to be an optimum ratio on which the more or less favourable conditions of the soil depend. To this end the author studied the decomposition of organic matter in soils to which had been added both pure and mixed cultures of bacteria or fungi.

During a period of 12 days the production of carbon dioxide was found to be more uniform than the accumulation of ammonia but, as a rule, a greater production of carbon dioxide (with pure cultures) was accompanied by a marked accumulation of ammonia when 1% of cottonseed meal or alfalfa were added to sandy loam. Pure cultures of fungi (*Aspergillus niger*, *Trichoderma*, etc.) oxidised more carbon, but caused the accumulation of much less ammonia than bacterial cultures. Soil infusions affected ammo-

nia accumulation in a way similar to fungi, but produced more carbon dioxide. Mixtures of pure cultures of bacteria showed no antagonism and in some cases a symbiotic relation appeared to exist.

It seems that when studying the optimum ratio between carbon-dioxide production and ammonia accumulation, other kinds of organic matter and the nature of the soils, as well as the effect of various manures and fertilisers should also be studied. The action of pure cultures of bacteria, actinomycetes, fungi, mixed so as to form a synthetic soil flora, also deserves study so that, in estimating the action of the natural flora of the soil, it may be possible to improve the soil and obtain from it the maximum yield without deterioration to it.

1335 - Nitrogen Fixation in Manure. -- I. TOTTINGHAM, W. E., (Wisconsin Agricultural Experiment Station, Madison), The Increase of Nitrogen in Fermenting Manures, in *The Journal of Biological Chemistry*, Vol. XXIV, No. 3, pp. 221-225. Baltimore, 1916. -- II. FULTNER, H. J. and FRED, E. B., (University of Wisconsin, Madison), Nitrogen-Assimilating Organisms in Manure, in the *Journal of Bacteriology*, Vol. II, No. 4, pp. 423-434. Baltimore, 1917.

I. — Various investigations (lasting from two to several months) of fermenting manure have nearly always shown more or less considerable loss in nitrogen; an increase in nitrogen has but rarely been observed (1). During recent work on the changes in a fermenting mixture of cow and horse manure an increase in nitrogen was observed after two and four weeks. This increase was followed by so large a decrease that after twelve weeks the loss in nitrogen was complete. The increase in the nitrogen content is much greater in straw-littered than in unlittered manure.

This fixation phenomenon was confirmed by laboratory control tests. The manure mixture was kept either in covered galvanised iron pails or inoculated with mannitite or other solutions. The results showed manure to contain nitrogen-fixing bacteria of considerable activity, especially when mixed with straw, which appears to be an important source of energy for these microorganisms. It is obvious that the increase of nitrogen in manure at the beginning of fermentation may prove of practical value in manuring soil if this increase is not counter-balanced by a simultaneous loss in organic matter. Experiments with straw-littered manure (gathered fresh and placed in covered boxes out of doors during the winter months so as to limit fermentation) applied to a rotation of maize, barley and clover, showed such manure to increase the yield in maize grain by 5.3 % and the yield in maize stover by 7.4 %, as compared with fresh manure with straw. This difference disappeared with barley and was reversed with clover. The results of these experiments, which lasted six years, were in favour of limited fixation of manure if the nitrogen so fixed can be utilised at the time of application.

II. — Later experiments made with liquid and solid cultures showed nitrogen fixation in fermenting manure to be due to certain forms of bacteria which appear to belong to different groups. The chief agent of nitrogen

(1) See R. Sept. 1917, No. 797. (Ed.)

fixation in manure, however, seems to be *Bacterium azophile* n. sp., present in large numbers in fermenting manure. The increase in nitrogen when this bacterium is grown on manure extract is from 3 to 5 mg. per 100 cc. of solution. The optimum temperature for the development of nitrogen fixing bacteria in manure appears to be 28° C. *Bact. azophile* seems to be widely distributed in nature.

1336 - **The Possibility of Obtaining Nitrogenous Fertilizers by Utilising Waste Materials for the Fixation of Nitrogen by Nitrogen-Fixing Bacteria.** — DORYLAND, C. I. T. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol. II, No. 1, p. 2. Baltimore, 1918.

While studying the energy relations of a soil flora experiments were made to determine which waste materials might serve as sources of energy for nitrogen-fixing bacteria. It was found that nitrogen fixation took place when either molasses, orange juice, lemon juice, grape fruit juice, wheat, oat, barley, rye or flax straw were used as sources of energy. Waste paper, wood wastes, grass residues and beet and cane sugar residues will probably serve in the same way. Under natural conditions nitrogen may be fixed by bacteria much more economically than by our present laboratory methods. The writer suggests that it is probable that the fixation of nitrogen by bacteria may be accomplished as cheaply as by electricity or even by a catalytic chemical process such as BUTCHER's cyanide process. The production of cheap nitrogen by the bacterial process will be attained by utilising waste materials as sources of energy, together with the correct combination of symbiotic microorganisms and the development by selection of highly efficient nitrogen fixing strains. These must be combined with a simple mechanical manipulation, with final evaporation by solar heat. A modification of the rapid vinegar process for waste liquids and a modification of the activated sludge process for solid materials such as pulps, straws and waste paper are possible points of departure for mechanical manipulation.

1337 - **Studies on the Absorption of Ammonia by Superphosphate: "Ammonium Superphosphate"** (1). — BRIOUX, C., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 21, pp. 632-638. Paris, June 12, 1918.

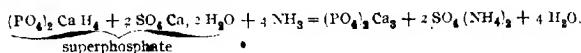
Since the war, the consumption of pyrites and sulphuric acid has had to be limited everywhere in Europe, especially for the manufacture of manures. As this has been particularly the case in Germany, in that country the sulphuric acid required to absorb the ammonia to produce the sulphate has been suppressed, and the ammonia (obtained from sewage-water, gas water or cyanamide) is absorbed by calcium superphosphate made with sodium bisulphite, a bulky and worthless residue of powder works. In this way a new phosphatic and nitrogenous manure has been obtained which is called, in the lack of another name, "ammonium superphosphate" and which will act on the plant contemporaneously with all its nitrogen and all its phosphoric acid, in spite of the reverted state of the latter.

As this new manure is of interest under present conditions, the author

(1) See *R.*, March 1916, No. 272. (*Ed.*)

has prepared a small amount to study its chemical properties, his observations being summed up in the present paper.

When insoluble tricalcic phosphate is attacked by sulphuric acid we get calcium sulphate and calcium acid-phosphate which corresponds to one molecule of phosphoric acid for one molecule of lime instead of three. If the superphosphate is treated with ammonia gas, the latter does not saturate, as one might expect, the acidity of the phosphate; it acts on the calcium sulphate, forms ammonium sulphate and reconstitutes the tricalcic phosphate, the reaction being as follows:—



It would thus seem that there is a grave disadvantage; water-soluble phosphate had been formed and then rendered insoluble again. But the author points out that the cohesion of this tricalcic phosphate is not the same; it has become such that it dissolves almost integrally (after preparation) in ammonium citrate and 2% citric acid. The superphosphate used for the tests had the following chemical composition:—total P_2O_5 , 15.60%; P_2O_5 soluble in ammonium citrate, 14.56%; water-soluble P_2O_5 , 13.03%. After saturating with ammonia gas and leaving in a thin layer to air dry for some hours, the composition was:—total P_2O_5 , 15.80% (1); P_2O_5 soluble in ammonium citrate, 13.10%; water-soluble P_2O_5 , 1.53%; P_2O_5 soluble in 2% citric acid, 14.10%; ammoniacal nitrogen, 4.97%.

As regards the solubility of its phosphoric acid in the usual reagents, "ammonium superphosphate" can, therefore, be considered as superior to basic slag.

It is true that the cohesion of the tricalcium phosphate obtained increases little by little with time and that the citrate solubility diminishes, but the new product remains soluble in 2% citric acid.

The author has made no cultural tests, but he points out that such tests gave good results in Germany. Besides, the solubility of "ammonium superphosphate" in weak reagents shows that it should be easily dissolved by the agents in the soil.

1338—*Production of Calcium Phosphate at Curaçoa*.—*Handelsberichten*, Year XII.
No. 593, p. 286; No. 591, p. 231. The Hague, 1918.

The calcium phosphate found at Curaçoa and in the two neighbouring islands, Aruba and Bonaire, is mostly derived from guano and marine animals.

These phosphates have been long worked, with great fluctuations and even stoppages. In the island of Aruba the working was begun in 1881 and attained its maximum in 1907 when 35 000 metric tons were exported. In the island of Curaçoa the highest exportation (32 000 metric tons) was made in 1884.

(1) Content slightly higher than that of the primary superphosphate on account of the loss of the water of crystallisation of the calcium sulphate; for 17 gm. of ammonia fixed 18 gm. of water are displaced. (Author.)

Owing to the exceptional conditions created by the war, the exploitation has decreased enormously, as is plainly shown by the following figures, giving exportation from the "Colonia de Curaçoa": — in 1913, 34 772; in 1914, 21 720; in 1915, 31 308; in 1916, 14 468; and in 1917, 4 000 metric tons.

1339 — *On the Diffusion of Aluminium-ions in the Plant World.* — ŠTOKLÁSA, J. with the collaboration of SEBOR, J., ZDOBNÍCKÝ, W., TYMÍCH, F., HORÁK, O., NEMEC, A., and ČWAC, J., in the *Biologische Zeitschrift*, Vol. 88, Pt. 4, pp. 292-322 + 10 Tables + Bibliography of 17 Publications. Berlin, 1918.

The author had long studied the diffusion of aluminium in the plant world (1) and its physiological function. In the present paper he gives the results of the latest researches he has carried out with his collaborators, results that shed new light on the function of aluminium in the various ecological categories of the plant world, that is, 1) xerophytes; 2) hydrophytes and hygrophilous plants; and 3) mesophytes flora.

Before giving his results, the author rapidly considers the literature on the subject, showing the great divergence existing between the opinions regarding both the diffusion and function of aluminium in the plant world, which renders these researches very timely.

The author has obtained most abundant and varied material from nearly every European country. Before analysis, the plants were carefully washed, especially the roots, and air dried. The data obtained for each species are given in numerous tables giving the percentage of ash in the dry matter, the percentages of iron oxide and aluminium oxide respectively in the ash and in the dry matter. The material was naturally grouped according to its ecological nature and the general results obtained for each of the 3 groups thus established may be summarised as follows: —

I. — **XEROPHYTES.** — The xerophilous flora is distinguished by the low content of all the organs of the plant in aluminium-ions. Occasionally barely traces of aluminium-ions can be found, e. g., in the flowers and seeds of Phacelia, which, at the most, show traces of aluminium oxide. The absorption of very small quantities of the aluminium-ions of the soil constitutes a physiological property characteristic of the xerophilous flora.

I. — **HYDROPHYTES AND HYGROPHILOUS FLORA.** — The inverse holds good for hydrophytes and hygrophilous plants, which are characterised by a high aluminium content, especially the algae, as is shown by the following amounts of Al_2O_3 contained in the dry matter: — in the Chlorophyceae, *Bryopsis* n. sp., 1.414 % and *Halimeda opuntia*, 1.419 %; in the Phaeophyceae, *Sargassum bacciforme*, 1.512 %; in the Rhodophyceae, *Delosseria*, 2.332 %. In the higher plants the root contains much more aluminium oxide than the epigeal part; thus, in the Equisetaceae, the dry matter of the root may contain from 1.737 to 1.775 % of aluminium oxide, and that of the epigeal part, 0.345 to 0.478 %. The same difference, often still more accentuated, occurs in the Lycopodiaceae, Cyperaceae, Polygonaceae, etc., all

AGRICULTURAL
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OF PLANTS

(1) See *R.*, January, 1914, No. 21. (Ed.)

very rich in aluminium. Many hydrophytes and hygrophilous plants contain in the dry matter of their root system from 0.104 to 0.766 % of aluminium oxide and in that of their epigeal part from 0.018 to 0.276 %. The flowers and seeds of the phanerogams analysed always contained aluminium, however, sometimes even in notable quantity. The general biological economy of the organism of hydrophytes and hygrophilous plants shows that the absorption by the cell of the aluminium-ions of the water or soil constitutes a special physiological requirement for these plants. The physiology of the cell here includes a special selective faculty, quantitatively determined for the aluminium-ion, which is concentrated in the higher plants in the roots, rhizomes, tubers or bulbs. In these higher plants, it is the general rule that the epigeal part always contains less aluminium-ions than the subterranean part. The absorption of considerable quantities of aluminium-ions and their deposit amongst the reserve material in seeds forms a characteristic physiological property of the aquatic and hydrophilous flora.

III. — MESOPHILOUS FLORA. — Plants growing in an environment of average humidity and which can be modified within certain limits, belong to the "mesophilous flora" (e.g. certain Graminaceae, Papilionaceae, Caryophyllaceae, etc.). When these plants grow in a rather dry environment the root and epigeal systems are extremely poor in aluminium ions; on the contrary, the same plants, growing in a damp or marshy soil accumulate, especially in their roots, notable quantities of aluminium ions.

There thus seems to be a well defined relationship between the diffusion of the aluminium ions in the plant world and the edaphic and ecological factors.

1340 — Experiments on the Resistance of Plants to Cold. — FANTANELLI, E., in *Atti della Reale Accademia dei Lincei*, Series V, Vol. XXVII, Pt. 3, pp. 126-130; Pt. 4, pp. 148-153 Rome, 1918.

Experiments were made with cultures in pots, each of which contains several plants. The pots formed a series of ten, receiving food salts in the following order, making it possible to distinguish the ions most important for the metabolism of the plant: —

- Pot 1) Control, spring water containing chiefly bicarbonate of lime.
- Pot 2) NaNO_3 (nitric nitrogen; cation with little or no food value).
- Pot 3) $(\text{NH}_4)_2\text{CO}_3$ (ammoniacal nitrogen; anion negligible).
- Pot 4) KHCO_3 (potassium; anion negligible).
- Pot 5) KNO_3 (potassium and nitric nitrogen).
- Pot 6) KH_2PO_4 (potassium and phosphoric acid).
- Pot 7) Mg SO_4 (magnesium and sulphuric acid).
- Pot 8) Na_2SO_4 (sulphuric acid; cation with little or no food value).
- Pot 9) $\text{NaNO}_3 + \text{KH}_2\text{PO}_4$ (complete fertiliser; nitric acid, potassium and phosphoric acid).
- Pot 10) $\text{NaNO}_3 + \text{KH}_2\text{PO}_4 + \text{Mg SO}_4$ (complete formula; potassium, magnesium and sodium).

I. — EXPERIMENTS MADE AT TEMPERATURES BELOW FREEZING POINT. — The plants (wheat, beet and sunflower) were grown in cold greenhouses for

January to April and then exposed to temperatures low enough to cause freezing. Wheat and beet, taken from an external temperature of 11°C, were cooled to -4.5°C in 5 hours. The temperature was then raised to 6°C. in 14 hours and, finally, the plants were warmed to room temperature. The sunflower plants, taken from a temperature of 12°C, were cooled in 3 hours to -3.5°C, and kept at that temperature for 2 hours. The temperature was then raised to 6°C. in 15 hours and the plants finally brought to 12°C.

II. — EXPERIMENTS MADE AT TEMPERATURES ABOVE FREEZING POINT.

— The plants (tomato and maize), grown in a cold greenhouse from April to July heated daily to as much as 38°C, were then exposed to temperatures a little above 0°C. so as to avoid freezing.

CONCLUSIONS. — 1) No immediate relation was observed between resistance to cold and the food value of the salts supplied to the plants. Nitrates diminished the resistance to cold most. Potassium and phosphoric acid inhibited the unfavourable action of the nitrates, but did not increase the resistance of the plants.

2) No relation between growth and resistance to cold was found.

3) No relation was found between the molecular concentration of the cell sap (determined by the cryoscopic method) and resistance to cold. The maize plants which resisted best were those which increased or maintained high osmotic pressure of the cell sap during cooling.

4) There is no relation between resistance or the density of the cell sap in wheat and beet. The most resistant sunflower, tomato, and maize plants were those the cell sap of which was richest in extract.

5) The proportion of mineral principles dissolved in the cell sap does not influence the resistance but, in the case of the tomato, the cell sap of the most resistant plants was poorer in minerals. During cooling the mineral principles of the most sensitive maize plants dissolved.

6) There was no relation between resistance and the proportion of free or combined acids present in the cell sap before cooling, during which the acidity of maize and tomato increased.

7) Before cooling no relation could be found between the resistance and the sugar or plastic carbohydrate contents. Nevertheless, the plants which suffered most were those which, during cooling, disposed of the least sugar, either because much of it had been destroyed or because sufficient starch was not dissolved.

Resistance to cold has, therefore, no connection with the concentration of the cell sap, nor with its content in acids or salts, but with the amount of sugar retained by the cell during cooling. The author intends to study whether the sugar acts only as a source of energy or if it protects the protoplasm against autolysis, as appears to be the case by its strong anti-protolytic action.

8) These relations were observed in cases of death by freezing as well as in those of death by cooling only. In both cases the drying up of the organs was proportionate to the deterioration suffered, and always occurred although the environment was saturated with moisture.

1341 - **The Influence of the Physiological Condition of the Seed upon the Course of Subsequent Growth and upon the Yield; the Effects of Soaking Seeds in Water** (1).
 -- KRUD, F., and WEST, C., in *The Annals of Applied Biology*, Vol. V, No. 1, pp. 1-12
 + 10 Tables + 5 Figs. Cambridge, July, 1918.

Of late years in most researches dealing with the seed the attention has been almost entirely concentrated upon the question of germination, while little attention has been paid to the eventual influence of treating the grain, which would show how far the physiological condition of the plant in the seed-stage may exert a pre-determining influence upon the whole subsequent course of growth and development. This importance of this question is obvious when it is said that the yield from an equal number of plants of a pure line may vary 50% or even more, owing to the pre-determining influence of the physiological condition of the seed as affected by environmental conditions both before and during germination.

The authors undertook to study this predetermined influence and, in the present paper, give the first results obtained by immersing the seeds in water at 17°C. for 8, 24, 48 and 72 hours. The seeds used were those of the pea (*Pisum sativum*), dwarf bean (*Phaseolus vulgaris*), barley (*Hordeum*), sunflower (*Helianthus annuus*), white mustard (*Brassica alba*), broad bean (*Vicia faba*), white lupin, wheat and oats. The effects observed on the rate of germination of the various samples thus treated, as well as on the yield of the plants obtained (length of stem and root), lead to the conclusion that *soaking the seed in water may have a marked effect on the subsequent growth of the plant*. The nature of the effect is strongly specific, quite different results being obtained by similar treatment upon closely allied plants, as is shown very strikingly by beans. The results of soaking the seeds of the dwarf bean even for 6 hours becomes evident after a month's growth by a decrease of 26% (as compared with control plants set dry) in the dry weight yield of the tops of the plants. Seeds of the same species, soaked in water for 24 hours before sowing, showed the most rapid and vigorous germination, while later, 12 days after sowing, the total length of these plants as compared with the controls set dry was as 2.4 : 13.8.

The results obtained with the Broad Bean are quite different: the effect of soaking the seeds was found to be increasingly beneficial, not only on the percentage of germination, but also upon the size of plant produced. Thus, 3 weeks after sowing, the average height of the plants produced from seeds planted dry was only 4 cm. as compared with 10.4 cm. in the case of those soaked for 3 days before sowing.

The photographs accompanying the article show clearly the effect of soaking the seed on the growth of the plants.

1342 - **The Influence of Temperature on the Germination of the Seeds of the White Mulberry**. -- AGUCA, C., in *Informazioni scritte*, Year V, No. 8, pp. 131-132. Rome April 20, 1918.

Laboratory germination tests of white mulberry seeds, distributed gratis by the Italian Ministry of Agriculture, for forming "prati di gelso"

(1) See also *R.*, June, Aug. and Sept. 1917, Nos. 533, 717 and 804. (*Ed.*)

(dwarf-plant plantations). In practice, a germination percentage of 50 % is satisfactory.

The tests show that, at 20° C., germination commences on the 5th day, taking place gradually, so much so that a final total of 23 % is obtained. At 25° C., germination begins on the 4th day, and the total is 34 %. The optimum is obtained at 30° C., with vigorous germination on the third day and a total of 62 %. At 35° C., there is diminished intensity (a total of 50 %) and, at 40° C., germination ceases. The influence of the temperature is, therefore, important, and growers should take it into account.

The experiments all show that the seeds are not harmed when they remain at a low temperature in a damp room or in the soil, as happens, for example, with autumn sowing. Growers should not be alarmed, therefore, if the season is cold and the young plants do not appear; cultivation should, on the contrary, be continued. But it may be more advisable to delay sowing until the temperature is sufficiently high to assure more rapid germination. It is not necessary to wait for the optimum temperature and a lower temperature may even be considered as sufficient, provided it is not too low.

As regards the amount of heat necessary for completing germination, the author shows that the nearer the favourable conditions of temperature are approached that amount is smaller.

It still remains to be seen whether the young plants obtained by using various quantities of heat have the same strength and subsequently develop equally quickly. The author is continuing his researches on this subject.

1343 — **Mutation Observed in a Pure Strain of Two Rowed Barley (*Hordeum distichum* L.), in Bavaria.** — KÜSSLING, L., in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. XIX, Pt. 3, pp. 145-150. Leipzig, June, 1918.

PLANT
BREEDING

In 1912 the author described a new variety of two-rowed barley obtained by mutation in the Vriesian sense in the 9th generation of a pure strain of *Hordeum distichum* described by the symbol Fg2. The new variety, described by the symbol Fg3, has the following characters: —

- 1) Leaves pale green as a result of decrease in the amount of chlorophyll and the number of chromatophore cells and chloroplasts.
- 2) More abundant tillering and greater development of foliage.
- 3) Longer ears and awns, shorter, but more numerous internodes, lighter straw.
- 4) Higher yield in grain.
- 5) High water content of the vegetative parts, lower resistance to cold, greater susceptibility to the action of external agents.

Numerous methodical observations and investigations made since 1912 show this variety to have remained absolutely constant so far, transmitting its characters integrally from generation to generation. It is, therefore, for unknown reasons, a true mutation, i. e. an unexpected hereditary variation. To what category of mutations does it belong? Is it a case of *progressive mutation* due to the appearance of new factors (determinants) capable of influencing the manner of growth and the formation of tissues, or a *mutation by loss* due to the disappearance of one or more factors?

The most striking character of the mutation is lack of chlorophyll with which, as easily explained physiological correlations, might be connected the other differential characters, or at least, many of them. The appearance of the new variety could then be explained by the loss of one or more of the factors governing the formation of chlorophyll. To prove whether this be really so the author made hybridisation experiments from 1911 onwards.

The mutated plant Fg3 was twice crossed with the parent Fg2, first in 1911, in the sense Fg3 ♀ × Fg2 ♂, then, in 1912, in the sense Fg2 ♀ × Fg3 ♂. The hybrids of the F_1 of both of these crosses were of a distinctly darker green than the form Fg3 and it was not possible to distinguish them with certainty from the Fg2 form. In the F_2 generation the averages from ten determinations were:— 2370 pale green plants, 6073 green (intermediate colour) plants, and 2591 dark green plants. The figures correspond to the Mendelian ratio 0.7 : 2.6 : 0.7. The theoretical ratio would be 1 : 2 : 1 (the excess of plants of intermediate colour being attributable to the fact that all doubtful cases were usually placed in this category). This ratio is that of a monohybrid.

If the designation Θ^2 is given to the chlorophyll factors common to the two forms Fg_2 and Fg_3 and the designation Θ^3 to the factor which has disappeared in the Fg_3 , the following gametic formulae are obtained:

$$\begin{aligned}
 F_{g2} &= G^x G^x G^v G^v & F_{g3} &= G^x G^x g^v g^v \\
 F_1 &= G^x G^x g^v g^v \text{ (darker than } F_{g3} \text{ and probably lighter than } F_{g2}) \\
 F_2 &= 1 G^x G^x G^v G^v + 2 G^x G^x G^v g^v + 1 G^x G^x g^v g^v \\
 &\text{as dark as } Fe_2 & \text{intermediate} & \text{as light as } Fe_3
 \end{aligned}$$

This would confirm the hypothesis of mutation by loss though it would be impossible to say whether σ^2 had really *disappeared* or was merely *latent*. In none of the numerous hybridisation tests did this factor reappear even sporadically. It therefore seems probable that the homozygous plant, F₂3, lost not only one factor, but a pair of factors.

As has already been said, the Fg3 form is distinguished not only by the colour of its leaves, but also by other characters, the existence of which may be considered to be an effect of loss of chlorophyll. Thus, the foliage tends to develop more to make up for the loss of assimilating power of the green surface, the total water content increases, the number of stomata decreases, etc. Nevertheless all these adaptations do not entirely compensate for the deficiency of chlorophyll, and the yield in grain of Fg3 remains inferior to that of Fg2. Moreover, the low resistance to cold of Fg3 is clearly connected with the higher water content of its tissues.

1344 - The Relation between Colour and other Characters in Certain *Avena* Crosses.

4 - THE RELATION BETWEEN COLOUR AND OTHER CHARACTERS IN CERTAIN AVENA CROSSES.
LOVE, H. H. AND CRAIG, W. T., in *The American Naturalist*, Vol. 1, II, Nos. 626-627, pp. 364-383. New York, August-September, 1918.

The paper under review gives the results of a series of crosses between *Avena fatua* and *A. sativa* made in order to study the inheritance of awn development, glume colour and pubescence.

CHARACTERS OF THE PARENTS. — *Ayen a sativa*: — glumes brown.

black, many awns, pubescent both inside and outside. *Avena sativa* : — pale yellow glumes, glabrous and few or no awns.

F₁ : — Characters intermediate between those of the parents, brown glumes, inner kernel always without awns, but with sparse dorsal hairs.

GLUME COLOUR IN *F₁* AND *F₂* : — In *F₂* there were three colour types, 310 black, 92 grey, and 18 yellow. Assuming *Avena fatua* to possess the factor determining black **B**, that of grey **G**, and that of yellow **Y**, i. e. the formula **BBOOYY**, and *Avena sativa* only the determinant **Y** and the formula **bbggYY**, the ratio in *F₂* should be 12 black-glumed plants : 3 grey glumed plants : 1 yellow-glumed plant. The numbers found (310 : 92 : 18) correspond fairly well to those calculated by this ratio (315.00 : 78.75 : 26.25), especially as the differences between the first and second are due to the difficulty of distinguishing clearly the plants with pale yellow glumes from those with pale grey glumes. If all the plants with glumes other than black are placed in one group, the ratio obtained is 310 with black glumes : 111 with grey or yellow glumes, corresponding to 3 : 1. This is confirmed by *F₃* which contains 230 black-glumed plants, 57 grey-glumed and 21 yellow-glumed ones.

RELATION BETWEEN COLOUR OF GLUMES AND DEVELOPMENT OF AWNS IN *F₂* AND *F₃* : — The percentage of awns was obtained by counting the total number of spikelets and the total number of awned spikelets and expressing the second as a percentage of the first. The following table shows these percentages in the black, grey and yellow *F₂* plants of the cross *Avena fatua* × *Avena sativa* var. Sixty Day.

| | Percentage of awns | | | | | | | | | | | Total | |
|--------|--------------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| | 0 | 1-9 | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 | | |
| Black | 46 | 25 | 20 | 23 | 12 | 17 | 21 | 23 | 14 | 8 | 2 | 99 | 310 |
| Grey | 11 | 9 | 6 | 10 | 3 | 10 | 6 | 5 | 1 | 3 | — | 28 | 92 |
| Yellow | 9 | 7 | 1 | 1 | — | — | — | — | — | — | — | 18 | 18 |
| Totals | 66 | 42 | 27 | 34 | 15 | 27 | 27 | 28 | 15 | 11 | 2 | 127 | 430 |

The black oats passed through all the different degrees from fully awned to awnless. The same may be said of the grey oats, except that the total number of awned plants is much lower. On the contrary, the yellow oats differed widely from the two preceding groups by the rareness of their awns (percentage of which did not exceed 30). It seems probable that the yellow factor has an inhibitory influence on the determination of awns. This hypothesis is confirmed by *F₃*.

RELATION BETWEEN COLOUR AND PUBESCENCE OF THE GLUMES IN *F₂* AND *F₃* : — The *F₂* of the cross *Avena fatua* × *Avena sativa* var. Sixty Day contained : —

a) 310 black plants, all pubescent, 112 on both glumes of the spikelet, 198 on one glume only.
 b) 92 grey plants, 26 of which had pubescence on both glumes of the spikelet, 42 on one glume only, and 24 of which were completely smooth.
 c) 18 yellow plants, all of which were perfectly smooth.

These facts show: — 1) an incompatibility between yellow glumes and pubescence; 2) the probable existence of two factors for pubescence, one of which is linked with the black colour factor. If this be so black oats would have two factors for pubescence, grey oats only one.

Assuming *Avena fatua* to have the formula **BB GG YY PP**, where **B** represents both the black colour factor and one of the two pubescence factors, the second one being expressed by **P**, the formula of *Avena sativa* var. Sixty Day would be **bb gg YY pp**, and its F_1 hybrids with *A. fatua* **Bb Gg YY Pp**. These hybrids form 8 different gametes, the reciprocal combinations of which, taking the inhibitory action of **Y** into account, should give in F_2 48 black pubescent plants, 9 grey pubescent plants and 4 smooth yellow plants. Between plants with pubescence and those with non-pubescent glumes there should be the ratio 57 : 7 (1), and of the 420 F_2 plants 374.66 should be pubescent and 45.94 smooth. The numbers found, 378 and 42 correspond very well with these theoretical numbers. The existence of two factors for pubescence, one of which is linked with the factor for black colour, is confirmed by an examination of F_3 .

A series of crosses between *Avena fatua* and *Avena sativa* var. Tart King gave in the F_2 pubescent and smooth plants in the ratio 15 : 1 or 3 : 1. In the second case ANOTHER TYPE of *Avena fatua* wanting in the determinant **P** and having, consequently, the formula **BB YY GG pp** must be concerned. If this type is crossed with Sixty Day all the yellow and grey F_2 hybrids are completely smooth. This second type of *Avena fatua* then has only one pubescence determinant, that linked with the black colour factor.

1345 — Methods for Selecting and Improving the Cotton Plant, in Egypt, — 8.
 No. 1356 of this Review.

1346 — Apple Selection in Canada. — MACOUN, W. T. (Dominion Horticulturist), in the *Federal Ministry of Agriculture, Canada, Dominion Experimental Farms, Horticulture Branch, Bulletin No. 86*, 151 pp. + 25 Figs. Ottawa, 1908.

As the demand for Canadian apples is continually increasing the Farm and Experimental Stations of that country have been working for some years with the object of obtaining good varieties that would do well in the climate of the North-West by working on 4 lines: — 1) selection of seed 2) acclimatisation and seed selection; 3) selection of bud variations; 4) crossing with wild or half-wild strains with a short vegetative period and very resistant to low temperatures.

1) SEED SELECTION. — By choosing from each tree fruit of good taste size and colour and sowing their seeds separately, plants may be obtained that tend to retain and transmit the characters for which they were selected.

(1) Not taking into consideration the inhibitory action of **Y** this ratio would be 15:1.

ed. In 1898 the Ottawa central Experimental Farm had an orchard containing about 500 varieties of apples which could produce countless combinations of characters owing to natural cross-pollination. The seeds of some apples of specially good taste and quality, especially the varieties Mac-Intosh, St. Laurent, Fameuse, Wealthy, Shiawassee, Swazie, Winter Scott, Salome, Lawyer, Gano, Northern Spy, winter St Laurent, Bullock (American Golden Reinette) were gathered and sown separately. In this way over a thousand varieties were obtained, of which 378 are now showing good promise, particularly Brock, Joyce, Melba, Pedro (from the Mac Intosh variety); Diana, Gerald (from Langford Beauty); Donald, Elmer, Lipton, Niobe, Rocket, Thurso (from Northern Spy); Galetta (from Wealthy); Ramona (from Shiawassee Beauty).

2) ACCLIMATISATION AND SEED SELECTION. — In 1890, an orchard was started with 3000 plants obtained from seeds of apples grown to the north of Riga, Russia. The number of varieties thus obtained gradually diminished, finally forming a small group with notable resistance to cold, which gives to varieties of Russian origin at the north of the 45th parallel marked superiority over those coming from the United States, which, however, are better to the south of that latitude. The varieties worthy of note are Duchess of Oldenbourg, Transparent Yellow, Claire, Neville, Oscar, Percival, Roslin, Rupert.

3) SELECTION OF BUD VARIATIONS. — Some varieties are created by bud variations. Thus, on the Fameuse apple, one or more branches occur bearing apples that are redder than those on the other branches. The Banks red Gravensteins, originating from New Caledonia, are also due to a bud variation. Up to the present, however, but few variations of this kind have been registered.

4) CROSSING. — Several Canadian varieties of apple have been obtained by crossing. For some years this has been carried out at the Agricultural College and Horticultural Station of the province of Ontario, and it is quite probable that good varieties will be produced by this method.

In 1887, the year when the Experimental Farms were opened, that of Ottawa imported from the Botanical Garden of Petrograd (Russia) some seeds of *Pyrus baccata*, a wild apple very common on the banks of Lake Baikal and in other regions of Northern Siberia; this apple is very resistant to strong winds and produces fruits as large as a cherry, astringent, acid and sometimes bitter. These seeds were sown at the Ottawa central Experiment Farm and produced a large number of plants which were distributed to the Experimental Stations of Brandon (Manitoba) and Indian Head (Saskatchewan). In the 20 years during which this Siberian apple has been on trial it has never been damaged by cold. It is somewhat dwarf, with low branches and a strong trunk; the fruit are firmly attached, which explains its resistance to the high winds that are frequent on the prairies of North-West Canada.

In order to enlarge and improve the fruits of *Pyrus baccata*, Dr. W. SAUNDERS carried out, in 1894, a series of crosses between that species and the best Canadian apples, in order to unite in one and the same plant the cha-

acters of "good quality fruit" and "resistance to bad weather." Some of these hybrids are as hardy as *P. baccata*, while producing much larger fruit than those of that species. Cultural tests carried out in a number of localities of the North-West gave really encouraging results.

Similar results were obtained by crossing the best varieties of Canadian and Russian apples with *Pyrus prunifolia*, a wild apple very resistant to cold and producing fruit twice as large as those of *Pyrus baccata* (some botanists consider it as a distinct species, others as the hybrid *Malus* \times *P. baccata*).

In hybridisation tests with the two above mentioned species pollen of the following varieties was used: — Tetofsky, Duchesse, Wealthy, Anis, Beautiful Arcade, Broad Green, Excelsior, Fameuse, Golden Reinette, Haas, Herren, Krimskoe, Red Mac Intosh, White Mac Mahon, Osimoe, Pewaukee, Red Astrakan, Ribston Pippin, Winter Scott, Simbirsk No. 9, Swayze, Grey Apple, Talman Sweet, Winter St. Laurent, Transparent Yellow.

After their multiplication and cultivation for some time in the North-West prairie regions, some of Dr. SAUNDERS's hybrids have proved to be very hardy and they represent a considerable advance in the creation of resistant apples for the North-West.

The following varieties, distinguished by the size of their fruit (diameter from 1.2 to 1.8 in.), are worthy of note: —

| | |
|---|--|
| Jewel (<i>P. baccata</i> \times Transparent Yellow) | Elsa (<i>P. baccata</i> \times Transparent Yellow). |
| Columbia (<i>P. baccata</i> \times Broad Green) | Eve (<i>P. baccata</i> \times Simbirsk No. 9). |
| Charles (<i>P. baccata</i> \times Tetofsky) | Dean (<i>P. baccata</i> \times Wealthy). |
| Silvia (<i>P. baccata</i> \times Transparent Yellow) | Pioneer (<i>P. Baccata</i> \times Tetofsky). |
| Tony (<i>P. baccata</i> \times Mac Mahon). | |

The seed progeny of these hybrids nearly all gave fruit smaller than that of the parents; this fruit was not big enough to stand comparison with those of the less hardy varieties. In order to obtain varieties with large fruit, while still sufficiently hardy to withstand open-air cultivation in the Prairie region, the above hybrids were again crossed in 1904 with the following good varieties of apple (providing the pollen): — Mac Intosh, Baldwin, Cranberry, Duchess, Northern Spy, October, Winter Scott, Simbirsk No. 9, Tetofsky, Transparent Yellow, Ontario, Gideon, Rideau, Haas, August, Walter, Wealthy, Mac Mahon. The seeds from these crosses were sown at Ottawa and gave 407 trees which began to bear fruit in 1910. Most of them produced fruit no bigger than that of the female parent, but 24 produced apples measuring more than 2 in. in diameter, especially the varieties: —

| |
|--|
| Wapella (Dean \times Ontario) with fruit measuring 2.2 \times 2.2 in. |
| Angus (Dean \times Ontario) with fruit measuring 2.0 \times 2.2 in. |
| Martin (Pioneer \times Northern Spy) with fruit measuring 2.2 \times 2.4 in. |
| Gretta (Pioneer \times Northern Spy) with fruit measuring 2.0 \times 2.2 in. |

As has been seen previously cross pollination occurring naturally between apple trees growing side by side may produce superior strains. There would be a much greater probability of obtaining tangible and sure results were the hybridisation carried out artificially. This the author has already

done by using the varieties: — Anis, Anisim, Antonowka, Baldwin, Bax-
ter, Bethel, Bingo, Cobalt, Crusoe, Duchess of Oldenbourg, Dyer, Danville-
Famous, Forest, Glenton, Gravenstein, Hibernal, Lawyer, Lowland, Rasp-
berry, Malinda, Milwaukee, Mac Intosh, Mac Mahon, Newton, Northern
Spy, North Western Greening, R. I. Greening, Rosalie, Rouleau, Scott,
Stone, Winter Rose, and Walton. At present there are about 1000 hybrids
being cultivated, of which 100 have already borne fruit. Some of the best
among the new varieties obtained in this way are Veimac (Lawyer ♀ ×
Mac Intosh ♂) and Rustler (Mac Intosh ♀ × Lawyer Mavis ♂).

1347 — **Selection of the Valencia Orange in California.** U. S. A. — SHAMEL, A. D., SCOTT,
L. B. and POMEROY, C. S., in the U. S. Department of Agriculture, Bulletin No. 624, 120
pp. + 4 Tables + 9 Figs. + 24 Plates. Washington, July 25, 1918.

The Valencia orange, widely cultivated in California, has no stable characters, as was hitherto believed to be the case, but is composed of a large number of strains capable of being isolated and propagated. These strains differ from each other in the size and shape of the fruit, habit of growth, period of ripening, etc. There are twelve principal strains: —

1) *Valencia strain.* — Trees erect with open heads having large, rounded leaves; irregular producers. Fruit globular, of medium size, slightly flattened at the blossom end; rind thin, bright orange in colour; juice abundant and sweet; 0 to 10 seeds per fruit with an average of 3. The fully ripened fruit is of good quality, inferior only to the Washington Navel variety.

2) *Corrugated strain.* — Trees with drooping branches and leaves smaller than those of the Valencia variety; less productive than the Valencia. Fruit oblong or cylindrical; large, thick, very rough, corrugated rind, greenish; little juice of poor quality and flavour; an average of 2 or 3 seeds per fruit.

3) *Long strain.* — Trees similar to Valencia trees in habit of growth and foliage, but less productive. Fruit oval, and much longer than that of the other strains; cross diameter small to medium; rind smooth and of a bright orange colour; juice abundant, sweet and of good quality; an average of 1 or 2 seeds per fruit. The shape of the fruit makes it unsuitable for packing and marketing.

4) *Ribbed strain.* — Branches drooping; very irregular production. Fruit globular, sometimes flattened at both ends, small, pale yellow; rough rind with ribs running from one end to the other, giving the transversal section a polygonal shape; juice abundant but inferior in taste and quality to that of the Valencia strain; an average of 2 seeds per fruit. The shape of the rind detracts from the commercial character of the fruit.

5) *Yellow strain.* — Branches drooping; annual production more regular than that of the ribbed strain. Fruit globular and small; rind thin, smooth and dark yellow in colour frequently with small red spots or streaks; an average of 1 seed per fruit. On account of their smallness and colour these oranges are commercially inferior to Valencia ones but ripen about a month earlier, a fact which makes them valuable under certain soil and climatic conditions.

6) *Smooth strain*. — Upright trees producing fruit similar in shape to the Valencia strain, but smaller and much less abundant ; the rind is very thin and very smooth (resembling the smooth strain of the Washington Navel orange), reddish-orange in colour; juice abundant and sweet; an average of 2 or 3 seeds per fruit. Although much less productive than the Valencia orange this strain may prove valuable in California if it is isolated and improved by bud selection.

7) *Barren strain*. — The trees have a drooping habit of growth, are very finely branched and have dense foliage ; they grow very vigorously and produce a very large number of flowers but little fruit. The fruit is small with a thick, rough rind and little juice ; they are of inferior quality and unsuitable for commerce.

8) *Rough strain*. — Erect trees of vigorous growth tending to produce a large number of suckers and abnormal branches. Fruit inferior in quantity and quality to that of the Valencia strain, with thick, rough rind of an orange-yellow colour, comparatively little juice of medium quality.

9) *Sporting strain*. — The trees vary greatly in production and habit of growth and are extraordinarily vigorous; the leaves also vary greatly in size and shape and the foliage is rather dense. The fruit varies very much and includes all the forms of the Valencia orange as well as others. As a rule these trees produce a few fruits of the Valencia strain which, on the whole, are of little value commercially.

10) *Flat strain*. — Upright trees bearing very little medium-sized fruit flattened at both ends (which gives them a characteristic appearance), with a thick, rough, yellow-orange rind and little juice. They are of no value commercially.

11) *Navel strain*. — The trees resemble Valencia orange-trees in their yield and habits of growth ; and their fruit is also similar in shape, size and colour but with a thinner and smoother rind and a small, often rudimentary, navel. This strain, which at times appears as a limb sport on Valencia trees, has been isolated and propagated commercially under the name of "Navelancia". It is of special interest because it is possible, by bud selection, to isolate from it a seedless strain of the Valencia variety.

12) *Willow-leaf strain*. — Drooping branches with leaves resembling those of the willow. Fruit is rarely produced and only in small quantities. It is very small with thick, rough, ridged and yellowish rind and little juice of inferior quality, making it quite useless commercially. It is one of the most interesting bud variations of the Valencia variety.

The eleven last strains are all derived from the Valencia variety (also known as Hart's Tardiff, Hart's Tardy and Hart's late) by bud variation which still occur in large numbers so that it is not unusual to find on one tree, or even one branch, two or more of these strains. Many of them, as has been seen, are of inferior quality. In choosing bud wood sufficient attention has not been given to the variability of the Valencia variety so that many valueless variations have been widely propagated.

In view of these facts the authors attempted : — 1) to determine the degree of variability of the Valencia orange and the comparative commer-

cial value of the different strains; 2) to determine, by the proportion of inferior oranges in the plantations, to what extent undesirable variations have been propagated; 3) to control, by improved methods of propagation, the entrance of undesirable variations in commercial Valencia orange groves.

During the four years 1912-1915, 105 orange trees of the different strains described above were grown. For each strain annual determinations were made of: —

A) *The number and weight of the fruit of the 1st, 2nd and 3rd grade.* — The 1st, or Orchard, grade includes oranges perfect in shape and colour. The 2nd, or Standard, grade includes fruit which is saleable although faulty in colour, shape, etc. The fruit of these two classes is graded into sizes varying from 288 (the smallest) to 8 (the largest) by a mechanical sizer. The 3rd, or Cull, grade includes unsaleable, inferior quality fruit which are not sized, only their number and weight being recorded.

B) *Average number of seed per fruit,* determined by examining three fruits of each class, i. e., nine in all.

C) *Number of fruits deviating from the standard type.* — For example, in the Valencia strain all ribbed or other forms are considered deviations, and in the ribbed strain all Valencia or corrugated forms, etc. In the Sporting strain fruit of the Valencia type is considered normal.

The results, given in four tables, are as follows: —

TOTAL FRUIT YIELD. — On a general average this is between a maximum of 171.6 lb. for a high-yielding Valencia strain and a minimum of 6 lb. for the Barren strain in the following order: — Valencia 131.8 lb., Sporting 127.6, Corrugated 113.5, Long 107.2, Coarse 99.7, Rough 98.5, Low-yielding Valencia 91.1, Small yellow 79.1, Unproductive 77.2, Smooth 75.8, Yellow 72.1, Barren 6.0 lb.

YIELD OF 1ST GRADE FRUIT. — High-yielding Valencia 125.9 lb. per tree, Valencia 92.8, Sporting 80.7, Long 66.5, Low-yielding Valencia 61.6, Smooth 60.6, Coarse 53.1, Unproductive 50.0, Yellow 36.5, Small yellow 36.1, Rough 27.6, Corrugated 24.7, Barren 0.9 lb.

PERCENTAGE OF VARIABLE FRUITS. — This percentage includes a minimum of 3.4 for the high-yielding Valencia and a maximum of 50.3 for Barren with the following intermediate figures: — Valencia 3.4%, Smooth 3.4, Low-yielding Valencia 3.8, Long 6.1, Coarse 6.3, Unproductive 7.2, Sporting 12.5, Small yellow 12.9, Yellow 30.6, Corrugated 34.5, Rough 47.3%.

CONCLUSIONS. — The Valencia strain undeniably occupies the first place, it has only a slight tendency to vary (3.4%) and produced much fruit, mostly 1st grade. It is the best orange from a commercial point of view. If selected the Smooth, Yellow, and Navel strains would prove valuable summer-ripening oranges. The other strains have no commercial value and should be gradually eliminated. By making observations similar to those described during a number of years and recording the results regularly it is possible to estimate definitely the value of an orange and thus to choose for propagation only those distinguished by low variability and a high yield of superior quality fruit. This system, though it does not exclude

completely the possibility of bud variations, makes it possible to obtain a high degree of uniformity and stability in the characters.

1348 - Measures taken in Hungary for the Production of Sugar Beet Seed. — *Wochenschrift des Zentralvereines für die Rübenzucker-Industrie Österreichs und Ungarns*, Year I, VI, No. 14, pp. 122-123. Vienna, April 4, 1918.

By an order dated March 21, 1918, regarding the production of sugar beet seed, the Hungarian Government has made some regulations based on the emergency war laws. The chief articles are given below.

Article 1. — Every sugar-beet grower who, in 1918, had undertaken, by a regular contract with a sugar works, to grow 25 hectares or more of sugar beets, is obliged to reserve $\frac{1}{25}$ of that area for the growth of seedbearing sugar beets.

The Sugar Beet Seed Commission (see Art. 10) can allow fractions less than that fixed to be cultivated for seed and may in part or wholly exonerate growers from that obligation beyond a certain limit.

Art. 2. — The beet grower must obtain his seed-bearing plants from seed with which he will be specially provided by the sugar works and according to rules laid down by the Ministry of Agriculture.

Art. 3. — The beet grower must inform the sugar works as to the quantity of seed-bearers obtained during the first year, and if the works does not make other arrangements, he must keep the seed during the winter. The sugar works will then communicate the information received to the above-mentioned Commission.

Art. 4. — On request being made by the growers, the sugar works are required to allow them advances at the time of declaring the seed-bearers up to the value of these and when the beets have been delivered for extracting the sugar.

Art. 5. — In the case when the sugar works does not make different arrangements and even if the ordinary cultivation contract has not been renewed, the grower is obliged to replant the seed-bearing sugar beet the following season and give them the usual attention.

Art. 6. — If the grower does not replant the seed-bearing beets the sugar works is authorised, after duly informing the Commission, to confide the cultivation of the beets in question to other growers, paying the produce twice the maximum price fixed for ordinary beets if it is in autumn and $2\frac{1}{2}$ times this price if it is in spring.

Art. 7. — The sugar works is obliged to take away from the grower, up till December 1, 1919, the seed he has produced, free at the consigning station, at a price equal to 18 times the maximum price, for that year's beets, that is, at a minimum of 250 kroner per 100 kg (11.3d. per lb.) and according to the rules laid down by the Ministry of Agriculture.

Art. 8. — The seed-bearing beets obtained in conformity with the present order are considered to be requisitioned, in the sense that they cannot be disposed of in other ways, save by authorisation of the central Commission.

If the sugar works has been unable to obtain the seed it requires in

this way, it can, through the Commission, obtain it from other works having too much seed.

The grower may not retain the seed he requires, but must obtain it from the sugar works.

Art. 9. — Each sugar works must inform the central Commission as to the growers undertaking to grow sugar-beet seed, indicating the names, surnames, farms, districts, as well as the area cultivated for seed. This declaration must be made within the 15 days following the publication of the present order or within the 10 days after signing the contract.

Art. 10. — To apply this order, a *Sugar Beet Seed Commission* is constituted, including a President, nominated by the Minister of Agriculture, 4 ordinary members and 2 deputies, of which 2 members and 1 deputy must be proposed by agricultural organisations and 2 members and 1 deputy by the sugar works. The secretary of the Commission is the Director of the Plant Breeding Institute or his representative. The expenses of this Commission are paid by the Ministry of Agriculture.

Art. 11. — The order does not guarantee the validity of contracts existing between growers and sugar works, contracts which must be in conformity with the dispositions of the said order.

Art. 12. — Whosoever directly or indirectly in any way infringes the clauses of the order is liable to a minimum of 6 months in prison and 200 kroner fine. If it be shown that the defendant has even made a profit, he shall pay, over and above the fine, a sum equal to twice such profit. If the goods forming the subject of the infringement are found they will be confiscated: $1\frac{1}{6}$ will be paid to the informer and the remainder, after costs are deducted, will be paid to the Disabled Soldiers Fund.

These measures are to be applied by those responsible for the public peace.

1349 — **Tests of Some Spring Wheats (Manitoba, Aurore and Marquis) in Vaucluse, France.** — ZACHAREWICZ, in the *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 29, pp. 825-828. Paris, October 2, 1918.

In 1917 and 1918 the author continued his tests at Avignon of Manitoba wheat for autumn and spring sowing, so as to find out whether its resistance to winter cold would be maintained and thus corroborate the results already presented to the Academy of Agriculture at its meeting on July 25, 1917 (1), results that may be thus summed up: Manitoba wheat has shown its hardiness and its resistance to winter cold and may be therefore considered as much as an autumn as a spring wheat for the south of France.

As in the previous year, the trials were carried out in the experiment field of the "Ecole Normale d'Instituteurs d'Avignon", with the collaboration of M. GUÉRIN, Professor of Physical and Natural Science at that school. The seed was drilled on land turned in autumn without any manuring. The previous crop was potatoes on broken-up grass-land with the addition of cake and calcium superphosphate. The author delayed the autumn sowing until December 15, 1917 so as to see how sensitive the germ was to

(1) As regards the varieties Aurore and Marquis see *R.*, June, 1918, Nos. 640 and 641. (E.A.)

cold. Just after sowing the thermometer fell so low that germination only took place between January 8-15 and very irregularly. In spite of this delay the wheat did not suffer at all. It was even so vigorous that in April it was topped to avoid lodging which partly occurred on June 17 during heavy rain accompanied by wind. The amount of straw produced per acre increased to 5085 lb. per acre. The date of harvest compared with that of spring-sown Manitoba was only advanced 5 days.

The test of seed from two soils of different chemical composition only gave a slight difference in the yield.

Seed obtained from bearded ears gave yields distinctly higher than those from beardless ears (27.4 and 21.2 imp. bus. per acre respectively).

At the same time the author tested the varieties Kurrachee, of Indian origin, Aurore and Marquis.

The variety Kurrachee behaved very well. The stems were 31 in. high and gave square ears with black awns. The seed is red and elongated. This spring variety is hardy and seems worth propagating. The yield was 26.1 imp. bush. per acre.

The variety Aurore arrived too late and the yield was low on account of the drought (10.7 imp. bus. per acre). When sown in March it gave much more conclusive results in another experiment field. For the same reasons the Marquis variety yielded still less (6.9 imp. bus. per acre).

1350 - Cultural Tests with Sol II Wheat in South Sweden. — AKERMAN, A., in the *Swedes Utsödforeningens Tidskrift*, Year XXVIII, Pt. 3, pp. 121-124. Malmö, 1918.

The Sol II variety of wheat, obtained from the cross Sol I \times Extra Squarehead II, is remarkable for the strength of its culms, its resistance to cold and early ripening which make it possible to sow (at the end of September) the seed which has just been gathered. The above cross was made in order to eliminate late ripening, the great defect of the Sol I variety. The seed of the same year, if sown immediately after harvest, germinate with difficulty, sometimes not at all, so that they have to be stored for some time to avoid these defects.

The new variety was tested in different localities in South Sweden, and the results obtained are given in the paper under review.

Tornby Station (near Linköping, Östergötland). — Below are given the average yields of the varieties tested for the period 1914-1917. The first figure shows the yield of grain in cwt. per acre, the second the relative index of productivity. Sol. I 31.37, 100; Sol. II 33.72, 107.2; Bore 31.21, 97; Iduna 31.09, 99.1; Renodlad Squarehead 29.47, 94; Thule 1 30.22, 96.3; Thule II 31.61, 100.8.

Svalöf Station (Scania). — During the period 1916-1917 the Sol II variety gave good results but was inferior to the Pansar and Fylgia varieties. Sol. II 37.19, 105.1; Pansar 37.59, 112.5; Fylgia 36.47, 108.

Ultana Station (Uppland). — As the north is approached Sol II gradually loses its value; in cultural tests at Ultana it gave results much inferior to those of Thule wheat.

CONCLUSION. — Sol II is the type of wheat most suited to Östergöt-

land and the districts of Västergötland and the province of Bohus with similar weather conditions. Further south Sol II may be used wherever Fylgia wheat is not sufficiently resistant to the winter cold and where Pansar wheat is too late.

1351 - **Pansar Wheat in South Sweden.** - ÅKERMAN, A., in the *Sveriges Utsödförings Tidskrift*, Year XXVIII, Pt. 3, pp. 117-120. Malmö, 1918.

Of all the different varieties of wheat recently put on the market by the Swedish Seed-producing Society, the best is "Pansar" wheat, obtained by NILSSON-EHLÉ from the cross Kotte x Grenadier. Since 1915, when it was first put on the market, it has become gradually more and more popular on account of its high yield and good resistance to cold and rust. The winter of 1916-17 was a good test for resistance to cold; the Tystofte, Smaa, Vilhelmina, and even the Fylgia, varieties suffered more or less, whereas Pansar resisted and gave an excellent crop. This may be seen from the following comparative data; in each case the first figure represents cwt. per acre and the second the relative index of productivity as compared with that of native Swedish wheat ("Swenskt lantvete"), equal to 100: - Native Swedish wheat, 21.5, 100; Pansar 35.8, 167; Fylgia 31.8, 148; Tystofte Smaavede 26.0, 121; Sol II. 33.3 154; Sol I 31.1, 145; Extra Squarehead II 27.8, 129; Vilhelmina 13.0, 62. The low yield of the last variety is the result of its lack of resistance to cold.

The superiority of Pansar wheat is due, not only to its strength, but also to: - 1) its late ripening which enables it to benefit by the July rains; 2) the presence of a waxy covering on the leaves which regulates and modifies transpiration. These characters make Pansar wheat the variety best suited to Scania (provinces of Malmöhus and Kristianstad). It also gives good results in the provinces of Halland, South Kalmar, Blekinge, Öland, and Gotland.

1352 - **The Rational Distribution of the Different Varieties of Rye in Sweden.** - LJUNG, W. E., in *Sveriges Utsödförings Tidskrift*, Year XXVIII, Pt. 3, pp. 97-116. Malmö, 1918.

The comparative cultural experiments made at Svalöf and the branch stations since 1906 have shown which varieties of rye are best suited to the local weather and agro-geological conditions of the different provinces of Sweden. The most important results obtained are below: -

SVALÖF 1907-1917. — *Varieties tested:* — Stiern and its line 0 302, Schlanstedter and its line 0 451, Irof, Heinrich and its line 0 280, Petkuser, Plobsteiner and its line 0 530, Bretagner and its line 0 420, Wasa and selected Wasa, Midsommar and its line 0 590, native grey oats of Östgöta.

Characters studied: — Yield in grain and straw per acre, weight of a bushel of grain, weight of 1 000 grains, strength of straw, shown by a number ranging from a minimum of 1 and a maximum of 10.

In all the tests taken together the Stiern variety ranks first for yield with 34.4 cwt. of grain per acre and 55.4 cwt. of straw. In weight of grain (55 lb.) per bushel, resistance to cold and strength of straw (7.4), it is more

or less equal to Petkuser, the yield in grain of which is 6.9 % lower (32.25 cwt.). One of the few defects of *Stiärn* rye is the length of its culm which causes it to lodge easily. The author's attempts to isolate forms with short straw have already given good results. The stalks of line 0302 are from 2 to 3 inches shorter than those of the parent variety and also stronger (strength = 7.7 as compared with 7.4 for the original *Stiärn*).

Certain new lines (Nos. 0 302, 0 451, 0 280, 0 530, 0 420) gave a yield in grain a little inferior to that of Petkuser. Line 0 280 (of Prof. Heinrich) is remarkable for the strength of its straw (= 8). It is hoped to obtain good types of rye for central and northern Sweden from all these lines. The Danish variety *Bretagner* is inferior to the varieties *Stiärn* and Petkuser, with which it can compete in dry years only, in light, mellow land. None of the other varieties tested gave good results.

What has been said for *Svalöf* applies also to the provinces of Malmö and Kristianstad, as well as to those parts of the neighbouring provinces where the soil and weather conditions are similar.

CENTRAL SWEDEN. — In the cultural tests made at the stations of Ultuna and Alnarp and the branch stations of Östergötland and Västergötland, the *Stiärn* variety, although followed closely by the lines 0 302, 0 451 and 0 280, nevertheless took first place with 27.1 cwt. of grain per acre (compared with 25.7 cwt. for Petkuser). The native varieties Grey Rye of Östgöta, Ultuna, etc. were inferior in grain yield to *Stiärn* and Petkuser by 15 and 16 % respectively.

At Alnarp the *Bretagner* variety yielded a little more than Petkuser. This was the result of the great drought of 1916 which put to the proof its special resistance to drought.

LOCAL CULTURAL TESTS: — Tests were made in the provinces of Kristianstad, Östergötland, Stockholm, Upsala, Örebro, Göteborg, Bohus, Halland, Västmanland, Värmland, and in the Island of Gotland. In the first seven provinces the *Stiärn* variety ranked first and in the provinces of Västmanland and Halland better results were obtained with the Petkuser variety. In Värmland the *Stiärn* and Petkuser varieties were surpassed by selected Wasa rye and, in Halland, by the *Bretagner* variety. The native ryes (of Östgöta, Gotland, Göteborg, etc.) proved in every case inferior to the selected ones.

As the north and interior are approached the environmental conditions become less and less favourable to the *Stiärn* and Petkuser varieties which gradually lose their value and supremacy through their insufficient resistance to the severe winters, and are replaced by selected Wasa rye (e.g. in the province of Värmland). In the province of Stockholm and in Västerbotten common Wasa rye yields more than selected Wasa. In the cold districts of Norrbotten the local native types do best. This is shown by the following relative indices of productivity:

In Västerbotten : — Native Norrland rye 100, grey Östgöta rye 98.4 selected Wasa 110.2, common Wasa 123.4

In Norrbotten : — Selected Wasa 62.4, common Wasa 72, native Norrland rye 100.

1353 - **Commercial Pulse Crops.** — *Bulletin of the Imperial Institute*, Vol. XV, No. 4, pp. 503-544. London, October-December, 1917.

The chief leguminous plants that are cultivated chiefly for the sake of their seed in both tropical and temperate countries are: — *Arachis hypogaea* (Ground nut, earth nut, pea nut [U. S. A.], monkey nut, goober), *Cajanus indicus* (Pigeon pea or bean, Angola pea, Congo pea, Dál [India], Bombay tares), *Canavalia ensiformis* (Sword bean, over-look bean, cut-eye bean [W. Indies], horse beans [Montserrat], Go-ta-ni bean [E. Africa]), *Cicer arietinum* (Gram, Bengal gram, chick pea, Spanish pea, Garbanzo [Spain]), *Cyamopsis psoraloides* (Cluster bean, Guar bean [India]), *Dolichos biflorus* (Horse gram, Madras gram, Kulthi [India]), *D. Lablab* (Indian bean, Lablab bean), *Ervum Lens* = *Lens esculenta* (Lentil), *Faba vulgaris* = *Vicia Faba* (Broad bean, Windsor bean, horse bean, field bean), *Glycine hispida* (Soy bean, soja bean), *Lathyrus sativus* (Chickling vetch, vetchling, grass pea, Indian pea, mutter or mattar pea, Khesari [India]), *Phaseolus aconitifolius* (Moth bean), *Ph. angularis* (Adzuki or Azuki bean [Japan]), *Ph. calcaratus* (Rice bean), *Ph. lunatus* (Lima or Duffin bean, Rangoon bean, Madagascar bean, butter bean), *Ph. Mungo* (Black gram, Urd [India]), *Ph. radiatus* (Green grain, Mung [India]), *Ph. vulgaris* (Dwarf bean, French bean, Kidney bean, haricot bean), *Pisum arvense* (Field pea, grey pea, dun pea, partridge pea, maple pea, blue pea, Bara mattar [India]), *Pisum sativum* (Common or garden pea), *Vigna Catjang* (Black-eye cow pea, cherry bean, cow pea, Chowlee, Lobia [India], Tow Cok [China]), *Voandzeia subterranea* (Bambarra ground nut, Mozambique gram, Madagascar earth nut). Although eaten as pulses in the countries where they are grown, ground nuts and soy beans are valued in Europe chiefly as oil seeds and they will therefore not be dealt with in this article.

Canavalia ensiformis (sword bean), *Cyamopsis psoraloides* (cluster or Guar bean) and *Voandzeia subterranea* (Bambarra ground nut) are of importance only in the countries where they are produced; they are, however, of value as food for man or for animals and a market for them may eventually be developed in Europe. Samples of "sword beans" from the Gold Coast, Honduras, Montserrat and Burma have been examined at the Imperial Institute, and no deleterious constituents were found in them, although they are considered to be harmful in some countries where they are grown, apparently on no very good grounds. Recently a variety of this species, called Go-ta-ni, has been received from British East Africa. Lablab beans are largely grown in China, India and other tropical countries. The Bambarra ground nut has also been examined at the Imperial Institute, and although no harmful constituents could be detected, it was not highly valued by merchants at that time (1909 and 1914). The great drawback to these pulses is that they are not known, and it is always difficult to find a market for them. The scarlet runner bean (*Phaseolus multiflorus*) is grown mainly for the sake of its green immature pods, but the ripe seeds are also eaten.

The most important pulses commercially are the various kinds of peas and beans. The chief countries that export peas in normal times are India,

Russia, Japan, China and the Netherlands; those exporting beans are China, India, Turkey, Russia and Egypt. The trade of the United Kingdom in pulses is normally sharply divided into two sections:—1) for human food; 2) for cattle food. The first section includes:—haricot beans, white and coloured (*Phaseolus vulgaris*); Madagascar butter beans, Lima beans and Rangoon white beans (*Phaseolus lunatus*); green peas, smooth and wrinkled varieties (*Pisum sativum*); yellow peas, smooth and wrinkled (*Pisum sativum*); field peas (*P. arvense*) split or ground into meal or flour; chick peas or Spanish peas, white kinds (*Cicer arietinum*); lentils, whole or split (*Lens esculenta*); Japanese "Adzuki" or Chefoo red beans (*Phaseolus angularis*); other small beans produced by *Phaseolus* sp. The second section includes:—dun peas, maple peas, partridge peas, grey or field peas (*Pisum arvense*); broad beans and horse beans (*Vicia faba*); pigeon peas or beans (*Cajanus indicus*); horse gram (*Dolichos biflorus*); Bengal gram or chick peas, coloured kinds (*Cicer arietinum*); all other kinds of coloured beans, including red Rangoon beans (*Phaseolus lunatus*). Various kinds of beans are known in British commerce as haricots, including the seeds of *Phaseolus vulgaris*, to which the term is more correctly applied, and the seeds of certain varieties of *P. lunatus*. Butter beans are furnished by other varieties of the same species.

Phaseolus vulgaris.—Before the war British supplies of true haricot beans were obtained chiefly from European countries especially Romania, Germany, Belgium, Italy and France. These beans were chiefly white—"White Italian", "White Soissons", "White Danubian"—but coloured varieties "Rose Cosos" (speckled), "Canadian Wonder" (purple); "Burlotti" (speckled) were also imported. Since the war the Royal Horticultural Society has imported from Holland the "Dutch Brown" bean, of a light coffee-brown colour, and said to be superior in flavour to the white forms. In tropical South American countries beans form to a great extent the staple food of the people and are grown in large quantities. Before the war these countries had to import beans, but the last few years they have become exporters. Thus Brazil, in 1914 only exported 4441 kg., while, in 1915, 276159 kg., and, in the first 5 months of 1917, 53084331 kg. were exported. Since the war Japan has also begun to export considerable amounts of haricot or kidney beans, that are either produced locally or imported from Manchuria, North China and Korea.

Phaseolus lunatus.—Originally native to South America, *P. lunatus* was introduced to Southern California as early as the fifteenth century, and is now widely cultivated throughout the warmer parts of the world. It was introduced into Madagascar about 1864, and since the French occupation it has become an important article of export. Madagascar traders wrongly call these beans cape peas or Pois du Cap, while on the London market they are called "butter" or Madagascar beans. In 1914, 8561 metric tons were exported, about 7 times more than in 1906 (1).

Forms of *Ph. lunatus* are largely grown in Burma. The two most com-

(1) See R., March 1918, No. 291. (Ed.)

mon forms grown in Burma are the red-seeded and the white-seeded kinds, known commercially as "Burma red beans" and "Burma white" or "Rangoon" beans and locally as Pé-gya and Pé-byu-galé. In 1916-17 Burma exported 1 439 009 cwt. of pulse mostly to the United Kingdom. The Imperial Institute has sent to Burma samples of Madagascar butter beans for trial; the local Department of Agriculture are testing other white beans. The cultivated forms of *P. lunatus* from Madagascar, South America and Burma and probably also from the United States and Southern Europe rarely if ever yield hydrocyanic acid in quantities likely to be injurious. On the contrary that acid has been found in beans from wild plants in Java and Mauritius; for these reasons importations from new areas should be examined before being placed on the market.

In 1916 the United Kingdom imported 1 077 600 cwt. of haricot beans as against 313 063 cwt. in 1913. Since the war the imports of this bean are mostly from India (over $\frac{1}{10}$ in 1917) followed by Madagascar and Japan.

Small-seeded Phaseolus. — The "azuki" bean (*P. angularis*) of China and Japan, "mung" (*P. radiatus*), "urd" (*P. Mungo*), "moth" (*P. acutifolius*) of India, and the "rice" bean (*P. calcaratus*) of India and the Far East are of great value as food-stuffs in the countries where they are grown, but are little known in Europe save as feeding-stuffs for cattle. *P. angularis* has been grown experimentally at the Arlington Farm, Virginia, U. S. A., with favourable results. Owing to its value for making flour or paste it should be tried wherever the haricot grows.

Vicia Faba. — The chief varieties grown in the United Kingdom are the following: — Heligoland bean; horse or tick bean; Scotch horse bean; winter field bean; early Mazagan bean; Long-pod bean; broad or "Windsor bean". The field bean is a common crop in Europe, and is largely grown for export in Egypt, Turkey and China. In 1916 the United Kingdom imported 1 110 605 cwt. of beans other than haricot beans. Before the war China, Germany and Turkey supplied a large proportion of the imports, but in 1915 more than half of the total import was obtained from British countries, British India and Egypt having increased their exports. A table gives the world's production of beans (area and crops) for 1910, 1911 and 1912; another gives that of peas.

*Peas (*Pisum arvense* and *P. sativum*)*. — In 1916 the United Kingdom imported 981 331 cwt. of peas as against 2 464 607 cwt. in 1912. Before the war peas were chiefly supplied by India, New Zealand, Germany, Holland, Japan; since the war Japan and China have increased their contributions.

Lathyrus sativus (mutter peas). — This is cultivated throughout India where it is known locally as Khesari. From Mediterranean countries the whiteflowered form has been introduced to Canada, where it is known as the "grass" pea, and is produced on a fairly large scale in Ontario. These peas have a high protein content but some forms are said to have poisonous properties which cause the disease known as lathyrism (paralysis of the lower extremities in man and animals) as a result of their continued use

as food. In India they are eaten by the poorer classes on account of their abundance and cheapness. The nature of the toxic substance causing lathyrism is not known. Seeds of forms obtained from India, Cyprus and Canada have been examined at the Imperial Institute with a view to the isolation of a toxic constituent, but with negative results. Investigations were conducted at the Agricultural Research Institute, Pusa, on samples obtained from Barail, a village near Pusa, which is notorious for cases of lathyrism, and the Central Provinces, where the disease also occurs, and it was found that samples of Khesari were often contaminated with seeds of *Vicia sativa* and *V. hirsuta*, from which a cyanogenic glucoside was isolated. It is possible, therefore, that the harmful properties attributed to the seeds of *Lathyrus sativus* may in some cases be due to obnoxious impurities. Experiments conducted in Canada with Canadian grown *L. sativus* peas as food for fowls gave good results and no harmful effects were observed. It has been found that lathyrism only occurs in man when *L. sativus* peas form almost the sole diet. There is now much evidence in favour of the view that the use of any one kind of grain, even wheat, as the sole diet may lead to harmful results.

Vigna Catjang (Cow peas). — There are 2 varieties, the bushy (var. *typica*) and trailing (var. *sinensis*), both grown in most warm countries. For use as pulse the white or blotched forms are preferred; they are much eaten in Burma, and are appreciated in the United States and to a smaller extent in the United Kingdom.

Lens esculenta (Lentils). — Largely consumed as human food in Europe as well as in the East. In English commerce two forms are met with, "French" and "Egyptian"; the former are large, ashy-grey externally, yellow inside, and are usually sold entire; they come chiefly from Russia and Germany; the latter are small brown, with an orange-coloured inside and are usually sold "split"; they come chiefly from India. In 1915 the United Kingdom imported 329 870 cwt. and in 1916 143 960 cwt. of lentils.

Cajanus indicus (Pigeon pea). — Two forms are grown, and some authors have made them species. One form has yellow flowers (*C. flatus*) and usually only 2 unspotted seeds in each pod; the other (*C. bicolor*) has yellow flowers streaked with reddish purple and pods containing 4 or 5 seeds which are usually spotted or streaked. Experiments made at the Labour Farm, Bihar and Orissa, between 1908 and 1911, proved that the tall erect form (*bicolor*) was the superior and best suited to local conditions. It is cultivated in most tropical countries. In Bombay it is known as tur, tuer, togari, in Bengal as arhar or rahar; in Africa as the Congo pea, Congo bean or Angola pea; in the West Indies it is called no-eye pea, and in Mauritius and the Mascarene Islands it is known as ambrevade. It is also grown in Southern Rhodesia, Madagascar and Australia. The pigeon pea is largely used in India for human food, and as fodder for horses and other animals when the crop is plentiful.

Cicer arietinum (Gram or Chick pea). — It is grown in most parts of Southern Europe, particularly in Spain; in northern Africa, chiefly in Mo-

occo ; in Asia, particularly in India, and in Mexico. About 500 000 acres are devoted to this crop in Spain, where the average production is estimated at 100 000 tons. In India the average area under grain for the 5 years 1909-10 to 1913-14 was about 15 million acres, with an average annual out-turn of about 3 million tons.

Experiments have recently been made at Pusa with a view to improving the types of chick peas grown in India, and 2 types have been selected, one producing a small whitish seed and the other a small reddish-brown seed. The former gave an average yield for 4 years of 1 600 lb. of seed per acre and the latter an average of 1 666 lb. for the same period.

The Indian chick peas are smaller than those of Europe, and are usually of a dark brown or reddish-brown colour ; they are chiefly used as food for cattle in the United Kingdom, but in India they constitute one of the staple foods of the people, being eaten either parched or boiled or ground into meal. Gram and barley roasted and ground into meal is known as "su too" and is sold in all Indian bazaars. Gram is much esteemed as a food for horses in the East ; it is, however, seldom given alone, but forms part of crushed foods. India furnishes most of the gram required in Europe ; in 1911-1912 India exported 6 934 840 cwt. and in 1916-17 761 930 cwt. of gram and forage-gram (*Dolichos biflorus*) ; the latter is grown chiefly in Southern India and shipped from Madras, the amount exported annually for the period 1911-12 to 1916-17 being 12 578 cwt.

Composition and food value of pulses. — The article concludes with a table showing the chemical composition of 21 pulses. If eaten in moderate quantities and properly prepared they are almost as digestible as other vegetable foods, but although pulses contain, weight for weight, as much protein as meat, they have not an equal food value as regards the nitrogen, since the proteins of meat are more readily absorbed than those of leguminous seeds.

1354 — The Production of Tapioca in the Dutch East Indies. — *Handelsberichten*, Year XII, No. 600, pp. 349-351. The Hague, 1918.

The cultivation of manioc (*Manihot utilissima* Pohl), from whose starchy root tapioca is produced, has only recently been developed in the Dutch East Indies, although, already in 1854, official initiatives were taken. The aim of the Government was to provide the native with an "auxiliary food stuff" with the object of guarding against the lack of ordinary foods, especially rice, in times of famine. The population required several years in order to appreciate the utility of this crop, which now is fairly well diffused. The analysis of the manioc roots, made at the Laboratory of the Colonial Museum at Haarlem, gave the following results for fresh and dry samples respectively : — nitrogen, 0.26 and 0.50 % ; albuminoids, 1.63 and 3.30 % ; fats, 0.94 and 1.90 % ; carbohydrates (expressed as starch), 39.79 and 80.60 % ; crude fibre, 2.10 and 4.25 % ; ash, 0.24 and 0.48 %. The fresh sample contained 50.63 % of water.

The native population eats the roots as they are — skinned, then cooked or boiled — or mixed with other ingredients. The product for export is

prepared in works, now very common, especially in Java. In this way are obtained : — 1) manioc or cassava flour ("tapioca-meel"); 2) those products, prepared under another form and higher priced, called "tapioca perlé" and "tapioca flake". The dried manioc roots and the by-products obtained in preparing the flour are also exported. The exports are mostly towards the United Kingdom, the United States and the Netherlands. The number of metric tons exported from 1915 to 1917 are given below.

| Products | Destination | 1915 | 1916 | 1917 |
|--------------------------|---------------------------|---------------|---------------|---------------|
| Manioc flour | Netherlands | 7 279 | 79 | 227 |
| | United Kingdom | 14 650 | 13 261 | 7 549 |
| | France | 3 273 | 511 | 58 |
| | United States | 13 314 | 37 655 | 31 473 |
| | Penang | 38 | 639 | 1 475 |
| | Singapore | 2 606 | 4 854 | 5 618 |
| | Hong-Kong | 1 847 | 2 313 | 2 896 |
| | China | 104 | 197 | 321 |
| | Japan | — | 57 | 473 |
| | Other countries | 706 | 55 | 206 |
| <i>Totals</i> | | 43 847 | 59 631 | 50 298 |
| Manioc by products . . . | All Countries | 2 612 | 913 | 103 |
| Dried manioc roots . . . | — | 31 546 | 8 378 | 1 522 |
| Pearl tapioca | — | 459 | 1 186 | 4 812 |
| Tapioca flake | — | 5 566 | 6 214 | 13 005 |

1355 — The Possibility of Developing Cotton-growing in Cambodia. — Dr. FLACOURT, in *Congrès d'agriculture coloniale*, Gouvernement général de l'Indochine, Saigon Series, Bulletin No. 5, 29 pp. Saigon, 1918. Review in the *Bulletin économique de l'Indochine*, Year XXI, No. 129, pp. 235-262. Hanoi-Haiphong, March-April, 1918.

Cotton is widely grown in Cambodia, along the banks of the Mekong and its chief tributaries, from Kratié to Banam, and along those of the Bassac, especially in the provinces of Saang (Residency of Kandal) and of Loeuk-Dek and Prey Krabas (Residency of Takev). It is grown on a large scale and throughout the country it is grown sporadically round the huts, even in the most remote and difficultly accessible districts.

VARIETIES. — Cambodia has four distinct varieties of cotton :—

1) "Krabas" or "Krabas bay" (*Gossypium hirsutum* L.) (1), of Amer-

(1) The Cambodian term "Krabas" (pronounced "Kreha") means raw unginned cotton, and has been extended to the cotton plant itself. This plant has hitherto been considered as a variety of *G. herbaceum* L. In this the duration of the vegetative life of the plant seems to have been taken into consideration far more than its actual characters. In Cambodia this cotton is annual, but it is the special cultural conditions to which it is subjected that make it so. Grown on banks flooded as soon as the waters fall, it naturally disappears when the waters, which cover all the flat country for 3 or 3 months, rise again. In the *Bulletin économique de l'Indochine* (p. 946, 1915) the author described it as a native type of the hirsute variety. (Author).

rican origin, usually known by the name of "Cambodian cotton". This is the only variety largely grown along the banks of the Mekong and the Bassac and their principal tributaries. It is the "Cambodian cotton" of India, where it was introduced some years ago and has been grown with good results.

2) "Kraban Tés" (*G. acuminatum* Roxbg.).
 3) "Krabas Sámré" or "K. Sangké", a type intermediate between *G. arboreum* L. and *G. indicum* Lamk. According to a determination verified by M. VIGUIER (Lecturer in Colonial Botany at the Sorbonne) it should be referred to *G. arboreum*.

4) "Krabas Sampau" (*G. arboreum*), found in 1915 in the Department of Siemréap; it has not yet been definitely determined.

The last three types are only met with absolutely sporadically. They were introduced very long ago, probably from India, whereas the Cambodian *G. hirsutum* seems to have been introduced a relatively short while ago, doubtless directly from America. This last is the most important of the four types of Cambodian cotton, both with respect to the acreage over which it is grown and the large quantities of cotton it yields, giving rise to a brisk trade. In his report the author deals only with this Cambodian type of *hirsutum* cotton.

The native crops are concentrated on the banks of the large river and principal watercourses (Chamcar) (1). They cover annually approximately 32 000 to 45 000 or 50 000 acres, according to the year, as the area cultivated varies with the height of the floods. As, in these soils cotton has to compete with other plants it is not possible to extend its cultivation much, the area of the banks being limited. Were it possible, by strong dikes, to protect from floods all the flat country behind the principal watercourses which form vast basins, the area over which cotton could be grown each year would be considerably increased. The best cotton lands in the State of Mississippi, U. S. A., were obtained by this method.

During the last six years the production of raw cotton in Cambodia was, in round figures:— 1912, 7 000 metric tons; 1913, 6 000; 1914, 8 000; 1915, 3 000; 1916, 5 000; 1917, 5 000. Most of the crop is ginned at the Khsach-Kandal works, and nearly all of it (except the 500 to 600 metric tons held back each year by the natives for sowing) is exported to Japan through Saigon, either directly or by way of Hongkong. The above figures show that the yield varies greatly from year to year. This is because, situated on the banks of the water-courses the native crops are cultivated at bad seasons. All the flat country is flooded by the Mekong (the floods of which are perfectly regular in duration) and it is impossible to choose the best time for sowing. The seed is sown as soon as the floods subside regularly and there is no more danger of their return. This occurs between the end of October and the beginning of December, and coincides with the end of the rainy season. Under these conditions the crops must depend largely

(1) The soil of the banks covered periodically by the floods are called "Chamcar" in Cambodian. (Author).

ly on chance. The relatively cold winter of Cambodia is early and if rain is more abundant than usual in March, April and May, the crop may be compromised.

These conditions also cause the fibre to be short (18 to 22 mm. at the most), irregular, woolly, and covered with small lumps caused by numerous completely atrophied seeds.

Attempts have been made to adapt cotton to soils sufficiently high to be completely free from floods. There is a considerable extent (19768 000 to 247 110 000 acres) of such land in Cambodia. They are mostly low table-lands, slightly raised valleys or large plains. The experiments were started at the end of 1913 and, after four years, showed beyond doubt that the Cambodian cotton plant adapts itself very well to these lands and gives in them a better quality fibre (less woolly, more regular, without small lumps, on an average 24 to 29 mm. long), thus showing it is better suited to them.

Samples of cotton obtained from the first cultural experiments were sent to the Jardin colonial in August, 1915. These samples were examined by several experts, traders and manufacturers at Havre. The cotton was judged well suited to the French industry whereas, to use to the best advantage that obtained from "Chamear" crops it would be necessary to modify or replace the machinery in French factories.

The author describes cultural tests made in red soil, soil of volcanic origin in layers of an average depth of 49 to 59 feet, purely vegetable, very permeable, but always cool, owing to the clay it contains. This soil covers an area estimated at 4 942 200 acres at an average altitude of at least 120 to 410 feet. During the experiments an average yield of 569 lb. of raw cotton per acre (without addition of fertiliser and without irrigation) giving 164 lb. on ginning was obtained. The yield of carded raw cotton was 34 %. The author estimates that the lands of Kompong-Cham and Kratié (1 482 600 acres), which offer a vast field for European and native colonisation will, when made fully productive, give an annual yield of more than 40 000 metric tons of carded cotton.

The improvement of the hirsute cotton of Cambodia by methodical selection is being undertaken by the local Agricultural Service, and, in spite of the difficulties due to present conditions, is almost accomplished. This, by multiplying the improved pure types, will make it possible to obtain a yet better yield of carded cotton.

One of the vital questions affecting the intensification of cotton production is that of the ginning industry and, to a lesser extent, that of the extraction of cottonseed oil. It is essential that the producer may be able to dispose of his crop, both immediately and progressively, at a remunerative price. The French cotton industry has too great an interest in this question not to give it full attention. The Association cotonnière coloniale especially has often interested itself in Cambodian cotton and is, therefore, in a position to do for Cambodia what it has done for West Africa, with a greater prospect of success.

The questions discussed above have attracted particularly the attention of the Chief of the Colony. No other crop is more suited to inclusion

in the economic programme of Indo-China than is cotton by reason of its rapid growth, great value of its product, and the ever-increasing necessity of freeing France from the onerous conditions of the foreign market.

1336 - **The Deterioration of Egyptian Cottons and Means of Remedying it.** — Mossékti, V. M., in the *Bulletin de l'Union des Agriculteurs d'Egypte*, Year XVI No. 124, pp. 53-79. Cairo, August-September, 1908.

While it is incontestable that the qualities of the Egyptian cottons, especially those of the old varieties, have deteriorated of late years, opinion is very divided as to the causes of such deterioration. According to the theory most generally accepted at present, the Egyptian cottons are suffering from a degeneration which has considerably reduced their yield and hardness. Become more weakly, the cotton plants are more sensitive to bad weather and less resistant to the attacks of insects and other parasites. The very great spread of the pink bollworm (*Gelechia gossypiella*) appears to be owing to this degeneration.

As regards the pink bollworm, so far no type of cotton has been found that really has a natural or acquired immunity protecting it from the attacks of this insect, any more than from those of its other pests. The author hopes that this will be attained by selection. In fact, in India, the pink bollworm is a secondary pest; and, every time that Egyptian varieties have been introduced into that country, they have been literally ravaged while Indian cottons grown close by hardly suffered at all. It appears that Indian cottons have a certain natural immunity in this respect, probably of a histogenous nature, since MAXWELL-LEFROY attributes the resistance to a more abundant resinous gummy secretion in the valves of their capsules. This immunity is the result of a natural selection which may some time take place in the case of Egyptian cottons and thus protect them from this terrible pest.

But in the meanwhile, other means of control must not be neglected such as cultural, biological or technical methods the chief among which are the removal and subsequent burning of the capsules remaining after the last harvest, the collection of the capsules fallen on the ground and their burning, the treatment of the seeds so as to kill any larvae they contain, the growth of early varieties and the use of methods of cultivation so as to hasten, or to avoid the slightest retard in, maturity.

Experiments were carried out in 1916 and 1917 by the Minister of Agriculture in order to study the means of hastening maturity by the judicious use of pinching and removal of the leaves combined with a gradual reduction in the quantity of water supplied after the month of July. The results obtained along these lines seemed encouraging (1). It was found that the intensity of the attack of the pink bollworm does not in any way depend on the age of the Egyptian varieties, nor on their degree of purity or degeneration; if there is any degeneration.

The author denies any such degeneration and attempts to prove that

(1) *The Agricultural Journal of Egypt*, Vol. VII (1917), pp. 120-135. (Author)

the Egyptian cottons have undergone a *deterioration* of late years and not a degeneration in the strict sense of the term.

The *quantity* and *quality* were affected:— 1) in the quantity (yield) the deterioration showed under the effect of *accidental causes*; 2) in the quality, it was shown by *essential causes*.

The accidental causes are due to the environment and their effects come under the heading of "fluctuation" and are not permanent.

The essential causes are due to the constitution of the plant, i.e., to the way in which it reacts to the environmental conditions; their effects are permanent.

The author only deals with the *quality*. The essential causes are the most important and originate in the impurity of the type grown. The most efficient cause of this impurity lies in the natural or artificial crossings to which Egyptian cottons have been or are still the object. This hybridisation is chiefly due to growing several varieties side by side or to the use of seed containing a mixture of different types. The remedies are clear: isolate and purify the cultivated varieties or seek better ones, multiply them and propagate them without it being possible to contaminate them. Three methods have been suggested.

1) The first was begun by BALLS in the laboratory of the Khedivial Agricultural Society, now the Sultanian Agricultural Society (1). It consists essentially in isolating a well determined type of pure strain, then, by crossing and methodical elimination, adding to the chosen type the advantageous specific characters that are required. This may be called the *addition or synthetic method*.

2) The second consists in annually isolating and selecting a certain number of plants showing the required specific characters. By repeated elimination of plants lacking the desirable characters the cases of atavistic throw-back to an undesirable type are diminished more and more in the progeny. This may be called the *analytic or elimination method*.

3) The third method is that of the *selection* of advantageous variations.

The ideal solution of the durable and permanent improvement of Egyptian cottons can only be obtained by applying the remedies quoted above. There is no great difficulty in purifying the cultivated types, and the multiplication of pure seed is also fairly easy. But the propagation of such seed free from the possibility of any future contamination constitutes the most delicate task for the moment. It is, however, an essential condition, as shown by the excellent results obtained in the United States by the rigorous application of these principles. The author recalls the work done in this direction in the United States, especially in Arizona (2).

The author thinks that to resolve the problem, if not radically, at least as satisfactorily as possible, an organisation should be created under the aegis of the Government, a sort of *permanent Commission* in which all those interested in any way in the production of Egyptian cotton

(1) See *R.*, August, 1915, p. 1017. (*Ed.*) — (2) See *R.*, May, 1916, No. 518. (*Ed.*)

—producers, brokers, spinners, etc., —should be fully represented by their most competent elements. This organisation would take the question in hand, with the widest possible powers, and would follow a programme, the outline of which is given by the author as follows: —

1) Divide Egypt into zones of different climates; create in each zone a chief station, with sub-stations should the type of soil require it, to undertake: —

a) the purification of the existing varieties or the creation of better ones by using one or another of the three methods given above, or, better still, simultaneously by all three methods;

b) repeated tests to ascertain the varieties most suited to each zone;

c) the scientific study of the cotton plant; in this it would probably be possible to collaborate with the powerful association (Cotton Research Association) now being formed in England to investigate scientifically in all the British Empire all the problems concerning the cotton industry.

2) Propagate the pure strains on land attached to these stations preparatory to multiplying them later on larger areas depending on, or rented by, the station, or cultivated by the owners under the direct control of representatives of the Permanent Commission.

3) Ginn the different types undergoing selection in machines belonging to the station.

4) Forbid the cultivation of several varieties side by side and only allow the cultivation in each zone of one of several varieties of those bound the most remunerative, allotting one or more special works to each zone for ginning.

5) Inspect the fields to eliminate plants not true to type, etc.

6) Control and regulate the sale and distribution of the seed.

7) Forbid the propagation of a new variety until repeated cultivation tests in the stations controlled by the Commission have indisputably shown its superiority over the corresponding type already cultivated. These tests would be made on isolated areas so as to avoid any contamination.

Pessimistic conclusions should not be drawn from what has been so far said, for the future may be faced with confidence and for a long time still Egypt will occupy the first rank among countries producing fine, long staple cotton. Even now, in spite of the sensible decrease in its cotton production Egypt always holds a preponderating place. In fact, whilst America produces 100 000 bales of Sea-Island cotton and hardly 6000 bales of the Egyptian type of cotton, Egypt still furnishes more than a million.

Egypt could have profited by this supremacy had its cotton market been better organised. This would also be a task for the Permanent Commission the organisation of which is urged by the author.

157 — *Four Large Scale Textile Crops: Jute, Crotalaria, Hibiscus, Sesbania, with a Note on Abroma.* — HUTEPECILLE, L. in the *Comptes d'Agriculture Coloniale. Gouvernement Général de l'Indochine*, Hand Series, No. 5, 65 pp. Hanoi-Haiphong, 1918.

The tests of textile plants carried out by the author on behalf of the Indo-Chinese Administration as the result of a mission to India in 1904 regard Tonkin and were spread over 8 or 9 years. They include ramie, jute,

the textile crotalaria, *Hibiscus cannabinus*, *Sesbania aculeata* and *Abroma augusta*. As ramie was worth dealing with separately (1) the other five plants are dealt with in the present study.

The utility of these tests is shown by the different conclusions to which they lead and which the author summarises as follows : — *Hibiscus cannabinus* seems unable to become suitably acclimatised to Tonkin; *Abroma augusta* will not grow healthily in dense plantations; *Sesbania aculeata* should do well in the alluvial, damp parts of the Tonkin delta; *Crotalaria juncea*, already tested at Hué and near Hanoi, is very hopeful and may prove a crop worth introducing into the country; jute, although finding in Indo-China less favourable conditions than those in British India may play, especially in Annam and Tonkin, on certain reduced points, an appreciable part.

1) JUTE. — This is the French and English name for two species of *Cochrorus* — *C. capsularis* and *C. olitorius*. Jute is probably the most important textile fibre after cotton and hemp. According to WIGMAN (*Revue des cultures coloniales*, December, 1902) the annual production of British India amounted to about 1 476 300 tons and, at that time, Calcutta exported 100 million gunnies. Indo-China imports about 10 million such sacks which might well be made locally. All the jute, manufactured or not, comes from Bengal where the crop covers at least 24 700 000 acres. The idea of cultivating jute in Tonkin suggests itself naturally, as there is much analogy, generally speaking, between Bengal and that colony ; the two deltas of the Ganges and Red River are mostly alluvial, abundantly provided with water; the climatic conditions are similar, labour is plentiful and easily satisfied. Ponds and watercourses are numerous in both countries, which is necessary for retting. The water communications help economically in the carriage of the bulky material. This material can be manufactured on the spot or exported through easily accessible ports. There are, however, sufficient differences between the two countries to call for caution ; in particular, the distribution of the rainfall is less even in Tonkin than in Bengal.

The author considers in turn the species and varieties of jute (the two species only seem to include about 40 varieties, the species *capsularis* having 30 and the species *olitorius* 10), the requirements and peculiarities of its cultivation, the experiments carried out at La-Pho, the yields per acre, and the cultural and economic possibilities of jute in Indo-China.

The yields of well-dried fibre, obtained in the La-Pho experiments were — 729, 923, 942, 892, 1 020, 1 030, 1 168, 1 236, and 1 275 lb. per acre. These yields are decidedly lower not only than those given by specialists, but also than those obtained at the Burdavan Experiment (Bengal) Farm, which reached as much as 2 641 lb. per acre. The highest yield obtained at the Phu-Thy Experiment Station was 1 445 lb per acre.

The highest monetary return obtained by the author (total return not profit), was 61.75 \$ per *mau* (2) and the smallest return 50 \$. takin

(1) See No. 1358 of this *Review* (*Ed.*)

(2) The *piastre* (\$) is worth about 2 s. at *par*; the Annamite *mau* equals 38750 sq. ft. (5)

jute at 12 \$ per 220 lb. At Phu-Thy 70 \$ per *man* was obtained. It may be said that the native gets a return of from 30 to 35 \$ from a *man* of land cultivated with jute. To obtain this, the expenses must not exceed those for maize or beans ; the native and his family have simply to pay more attention to the crop. The choice of the moment for preparing the soil and sowing requires more care than for other crops. The operations of harvesting, cutting, retting and baling jute are more heavy than for any other crop. The author thinks this is the only consideration to take into account with the gross yield.

Although jute growing does not pay for European colonists, its growth by natives would only be possible when it is encouraged and supported for some years by the European colonists, who would act as bankers and exporters. In the future the help of the European colonists will probably be able to be dispensed with as the natives become more enterprising and less sedentary when, with them or by their help the intensive agricultural occupation of Central Tonkin will be undertaken.

II) *CROTALARIA* (*Crotalaria juncea*). — This papilionaceous legume is largely grown in British India for its fibre, which is treated locally and exported to Europe under the name of " Sunn hemp ". Though inferior to jute it is very useful in mixtures. It is the only crotalaria cultivated out of the 30 species belonging to the Bengal flora. It is used for green manuring and its leaves and seeds are fed to live stock.

M. LEMARIÉ, at Heré, has been interested in this non-exhausting, but probably improving plant (owing to nitrogen-fixation by its root nodules), which is grown over such large areas in India that it may be inferred that the plant is not difficult and does well in varied soils and climates. He was aware that it can be harvested and defibrated more rapidly than jute and that it can more easily be introduced into crop rotations as it grows and flowers all through the year. According to the literature on the subject, a crotalaria requires less care than other crops.

The La-Pho experiments on *Crotalaria juncea* were not as ample as was necessary, but they have shown that it gives good and very regular yields in Tonkin ; few crops are so easy and safe. Its growth and harvesting are always sure with the minimum of work : — ploughing once, harrowing once, no weeding, prompt retting, easy defibration, the possibility of harvesting after 75 days or leaving the crop standing without serious harm.

The financial return is low and the crop does not always find a ready sale. In fact 62 $\frac{1}{2}$ to 71 $\frac{1}{4}$ lb. of dry commercial fibre per acre, at 27s. 9d. per 220 lb. gives 58.3 s. and 90s. per acre or 35 to 40 \$ per *man*. But this is the maximum ; the minimum yield of 446 lb. per acre or 25 \$ per *man* must be taken as a basis for calculation.

These are fairly good yields and would satisfy the native, considering the small amount of work sunn hemp requires ; but they would not suffice for European colonists working directly. In order to encourage the natives to grow crotalaria, a fibre market should be established in Tonkin.

III) *Hibiscus cannabinus*. — From tests made at La-Pho and Bat-Bat

(Tonkin) it was found that *Hibiscus cannabinus* or Deccan hemp (1) or one of its varieties or varieties of *Hibiscus Sabdariffa* (or "Roselle hemp") may be of interest as a crop for Tonkin and, better still, Annam, in order to provide a fibre for local needs, especially in the mountain region. But it is not the moment to anticipate an important yield, not only on account of the cultural requirements of this Malvaceae, but especially because, in the Delta and Central regions, it does not fit in with the crop rotation: — if it is to follow a maize crop it cannot be harvested in time to follow it by rice.

IV) *Sesbania aculeata*. — Leguminous plant also known as *Aeschynomene spinulosa*. This crop, which furnishes the "dunchi" of Bengal, may be grown in Tonkin in the future. It is a fibre for low, damp soil, and its growth, like that of *crotalaria*, is always sure in Tonkin with encouraging regularity; it has, moreover, the advantage of not being exhausting. But its fibre is inferior to that of jute and at present is only of interest for mixing with jute. The author thinks this fibre is not used alone industrially. *S. aculeata* gives fine crops in Tonkin and grows to a size there that helps it to resist passing floods.

V) *Abroma augusta*. — This Sterculiaceous plant produces a fine fibre, but does not enter easily into large-scale cultivation. It has to be grown suitably spaced, for as it branches greatly, it cannot be crowded, so as to obtain big and paying yields. In 1917, 3 plots of 300 sq. metres each, one 1 metre apart, the second 50 cm. apart, the third 35 cm. apart, gave respectively: — 1) 95 kg. of green material = 3.56 kg. of well dried fibre, or 3.75 %; 2) 40 kg. of green material = 1.05 kg. of well dried fibre, or 2.64 %; 3) the third plot was very bad. Grown under suitable conditions *Abroma augusta* does not yield 178 lb. of fibre per acre.

So that the new trials might be justified, the price per kg. of the fibre would have to be 3 francs which, in spite of the beauty of the fibre, is not probable, unless some special use for it is discovered.

1358 — Observations on Ramie in Indo-China. — HAUTEFEUILLE L. in the *Comité d'Agriculture coloniale, Gouvernement Général de l'Indochine, Hanoi Series, No. 1, pp. 51. Hanoi-Haiphong, 1918.*

In his report to the Congress of Colonial Agriculture the author throws light on the ramie question as regards the exclusively cultural point of view. He has followed all that has been done on the subject of ramie for the last 40 years with the greatest attention. In this work he has collected and condensed all that has been published on the question in all the world as well as his own papers (especially in the *Bulletin économique de l'Indochine*, No. 115, September-October, 1915) containing data never before published and his personal observations. His work is, therefore, very complete and of decided importance for all those interested in the ramie question.

The author considers successively and in detail the requirements of ramie as regards soil, climate, manuring, depth of ploughing, permeability of the soil, effects of drought, sun and heat, irrigation, plantation, hoeing

(1) It is the "da" or "dah" of French West Africa. (Ed.)

and weeding, cutting, duration of a plantation, yield in fibre, presence and disadvantages of gum, treatment of the crop. He then describes experiments carried out at La-Pho (Tonkin). These experiments were insufficient but gave some results which are duly recorded.

SPECIES AND VARIETIES. — There are 4 ramies: — white ramie (*Boehmeria nivea*), green ramie (*B. utilis* or *Urtica tenacissima*) and two that have been found at Laos or Yunnan, one red, the other yellow. There are no striking differences in the general appearance in full growth of the various ramies, at least as regards the height. The observer must walk down the lands in order to see differences which regard mostly the number and thickness of the stems and the thriving appearance. The foliage of green and white ramie is always denser, with larger and darker leaves. The stems of yellow ramie are generally weaker than those of other ramies. As regards the number of stems the red and yellow were equal, while being inferior in this respect to the two others. This did not hold true at the beginning and end of summer. Winter has a depressing effect on all 4 ramies. The green species is persistent and the white is deciduous. This is very characteristic of white ramie, and less so of the red and yellow ones. But green ramie, if it is not deciduous, grows so poorly that it cannot be utilised for at least three months. It long survives the hot season and dominates the others in October and November, but, in January and February, it completely ceases growth, only recommencing when white ramie begins again (March-April), almost regaining the lost time. At the end of the season green ramie wins and only begins to weaken in November, while white ramie begins in July.

Green ramie visibly suffers during the winter, whilst the white, though stopping growth in winter, retains its initial vigour; but the growth of the latter stops as soon as the heat becomes intense and continuous. Moreover it suffers visibly from sudden heat waves. These observations were made during the 2nd and 3rd year and the author adds those made in the 4th and 5th (last) of the plantation: — green ramie gradually fades from year to year, as does the white though less clearly if still visibly owing to the effect of the great heat.

INFLUENCE OF THE SOIL. — This is considerable. Valleys of secondary watercourses could probably be found with the rich and permeable soils that suit ramie; very few such soils are free from the danger of floods and cold.

GROWTH AND SPACING. — Growth was rapid, but limited, quickly stopped. The stems attained their full length in 6 or 7 weeks, afterwards making little progress. No stems were obtained more than 63 in. long, save in the La-Pho garden and in a specially treated field, where some as long as 86 in. were obtained. The plants were 20 in. apart in the rows and 28 in. apart between the rows, an insufficient density.

HOING AND WEEDING. — Ramie must always be kept very clean, which is expensive. Summer weedings should not be less than 4 and to keep it as clean as is really necessary, the number should be 8. The author reckons that the upkeep alone of the plantation costs 20 piastres per man.

PERCENTAGE OF FIBRE. — From 44 lb. of green material weighed the day when cut (after 24 hours the weight has already decreased by 10 %) percentages of fibre were obtained varying from 2.78 to 3.38. Each year, the first cut gives a higher percentage.

YIELD AND COST PRICE. — The author has estimated a yield of 1220 lb. of 'hemp' per hectare for 3 cuts in the year, or 475 lb. per *man*. Considering that it might be sold at 600 francs per metric ton or 129.60 fr. per *man*, i. e., 52 *piastres*, the expenses (hoeing and weeding, cutting, defibration, drying of fibre, baling, depreciation in 10 years of plantation) come to 50 *piastres*.

RAMIE IN INDO-CHINA (CONCLUSIONS). — As has been said, 4 varieties were under consideration : — white ramie, green ramie and the two yellow and red varieties ; of these the first two seem of most interest. Although the observations made are insufficient to allow a final classing, they justify the apprehensions felt by the author during the trials regarding this crop about which all has to be yet learnt. It appears that green ramie (*Bocconia utilis*) would not give the regular and abundant crops reported from other warm countries. Green ramie is persistent and seems to be the variety most suited to very hot climates with no winter. It suffers in Bengal, where it falls short of its reputation, as the author found with Mr. PRAIN, at the Calcutta Botanical Garden, and with Anglo-Indian planters. White ramie, on the contrary, seems to be the variety for temperate climates. It does well in France in Vaucluse, Limoges, even at Gonnehemilliers, as is known, but it does not resist the trying summers in Tonkin.

Yellow and red ramie are acclimatised in Tonkin. Yet they grow less vigorously than the white ; they run no risk there, but their stems are less fine.

It is only a question of appearances, noted not only at La-Pho, but also on private estates. Several years of observations are required in order to find by what modifications of the classical cultural methods the yield of those ramies already acclimatised may be improved or the influence of the climate attenuated for the exotic, white and green ramies. But there is another question, apart from the purely cultural stand point, that relates to the production of ramie — to find a rational cultural method so as to obtain, with the minimum expense, good quality ramie fibre, utilisable commercially, in paying quantities, from plantations of sufficient duration.

The chief of the La-Pho station was aware that the really rational cultural conditions for ramie were unknown. All remains to be learnt and discovered, for no plantation in the world has been continued successfully, giving lessons, examples, or, if it exists, it has not been revealed in such a way that it can be considered as a living enterprise for cropping ramie fibre. The amateurs, for conceit, inventors and business men for self-interest, have not always made known what they have learned or have often asserted that of which they were ignorant, when they have not deceived the public.

The observations made at La-Pho in 10 fields, i. e., on 10 different sites, over an area of 2 *mans* have shown that the choice of sites suitable

for ramie is very limited, so much so that it may be foreseen that large areas will not be occupied by this crop as yet in Tonkin. In fact, clay soils, with abundant moisture, are unsuitable for ramie, as are highlands whether they are hard, stony or sandy. Ramie can be grown neither on slopes, nor on narrow terraces that dry up in a few days, or on impermeable terraces.

Alluvial, rich, deep soils, theoretically so suitable, are, for several months of the year (those when growth is at its maximum and when the ramie should produce), soaked like a sponge. A plantation can only be started if water can be removed or given, by drainage and irrigation, at the required time. It is, therefore, if one wishes to grow it on a large scale, a crop for an engineer and a clever, resourceful engineer. Besides, all these soils are threatened by the great floods, which are fatal to ramie.

So much for the large-scale cultivation of ramie and it is worth while to add that ramie can be grown almost everywhere, round the house in tiny plots of soil, raised near the houses, cultivated like gardens, with soil brought to the spot, as it is grown on high land by the mountain dwellers who might produce much more were they guided and encouraged by better prices.

The studies and practical tests made by the author have resulted in these observations, which state the problem much more clearly than before. The result is not very encouraging and only enables the author to indicate the difficulties to be overcome, the illusions to be avoided and a programme of researches to be carried out.

Ramie has been discussed too much in scientific literature and business circles for the Indo-Chinese administration not to have attempted to ascertain whether, as has been asserted with confidence, Tonkin is suited to the crop.

1350 - **Agave Cultivation in Tropical and Intertropical Countries Especially Madagascar.** — HOFFMANN, A., in the *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year III, No. 10, pp. 210-226. Tananarive, 1918.

Of late years agave cultivation has continuously extended in nearly all tropical and intertropical countries. In order to encourage the growth of this crop in Madagascar the author publishes the following general information as to this textile plant and its production.

The agave is indigenous to Mexico, South America and the southern part of North America. The first plants were imported into Europe and India about the middle of the sixteenth century but Europeans only began to take an interest in this crop towards the end of the nineteenth century. The following species are known: —

Agave americana, the maguey of Mexico, growing wild in temperate zones, with a very fine, white fibre; its sap is used in treating skin diseases. *A. decipiens*, or false sisal, of no cultural interest. *A. mexicana*, imported into Madagascar, where its growth is not advisable on account of the strong, lateral spines. *A. vivipara*, one of the few varieties suitable, for damp soils, mostly grown in India. *A. Leopinassei* or "Zapupe" (VINCENT), one of the best varieties for yield and hardiness. *A. rigida* var. *elongata*, indigenous

to Mexico, prefers a warm, dry climate and very dry, stony, calcareous soils; rarely grows above an altitude of 1000 ft. One sisal plant yields 16 to 40 leaves a year; the fibre content varies from 3.5 to 4.2 %, according to the soil; besides extracting the fibre, attempts have been made to extract alcohol from the pulp (residue of the decorticated leaves).

Although very hardy, agaves have certain requirements: light volcanic soils, dry and rich in lime suit them best; too damp or clayey soils should be avoided. Shade and torrential rains are very harmful. In short, they require a tropical climate, well drained soils and a distinctly dry season.

As regards the nursery and the preparation of the soil the author gives the following advice: —

If the soil is not rich enough, some manure mixed with wood ashes should be turned under. The earth should be banked up well round each plant and the soil must be kept free from weeds; when, after 12 or 16 months, the plants are 14 to 16 in. high, they can be transplanted. The methods of preparing the soil and planting obviously vary according to the district; the soil should be well cleaned and tilled, and if too poor in lime, it should be limed. The distance between the plants varies according to the districts and is controlled by the desire to plant as many plants as possible per hectare; the author advises 78 x 98 in. or 78 x 118 in. which gives 1650 or 2000 plants per hectare; After transplanting, before or towards the end of the rainy season the attention required consists in replacing dead plants, cleaning or weeding, removing the suckers that live at the expense of the parent plant (these suckers, dried in the sun serve, with the bulbils, for reproduction).

The harvest takes place 3 years after transplanting. Mature leaves can be recognised by their yellowish-green colour and the silver-grey colour of the terminal spine; at the first cut each plant can give 25 to 35 leaves.

The author next gives details regarding transport to the works and the works itself that may be required near a plantation. He gives a scheme for a plantation, with running expenses for Madagascar, and arrives at a total of 200 000 francs (including the works and not counting administrative expenses) for a 200 hectare plantation in Madagascar. Under these conditions the cost price per hectare ready to be exploited comes up to about 1000 francs. If the yield is calculated, it will be seen that the products of the first two years will pay all the cost of plantation. In countries where labour is still relatively cheap and the value of land moderate (as in Madagascar) a profit of 500 to 600 francs per hectare per year may be counted on.

In conclusion the author remarks that the agave is one of the few plants that suffer little from insects and fungi; even locusts rarely attack it.

1360 - The Production of Plant Essences in the Dutch East Indies. — *Handelsrichten*, Year XII, No. 5/6, pp. 349-352 + 2 Tables. The Hague, 1918.

The resumption on a large scale, after the war, of the manufacture of scented soap and perfumes, will make the production of plant essences very

important. The plants that produce these essential oils in the Dutch East Indies are wild or cultivated.

Among the wild species may be mentioned the "cajuput" (1) from which is obtained cajuput oil by distilling the leaves. Adulteration with paraffin, benzine, etc., is all the more common as it is not easily detected; adulteration may, however, be detected by violently shaking a bottle half-filled with the oil; the air bubbles produced vanish at once in the pure liquid, remaining, however, for some time in the adulterated product. The green colour of the oil is due to the presence of copper and chlorophyll compounds; this is why a small piece of copper is often added to the product. Cajuput oil is much used in therapeutics. It is mostly exported to Singapore, the chief market of the product for British India. It is also sent to the United States where it is used in making a number of proprietary pharmaceutical products. Good quantities are also bought by Siam, Hong-Kong and Timor Island; in Europe, the chief buyers are Great Britain, Holland and Germany. In 1913, 1914 and 1915 the total exports were 124 228, 65 469 and 79 863 kg. At present there is a tendency for eucalyptus oil to replace this product.

The species cultivated occupy an area of about 3 000 hectares, 2 700 of which are in Java alone. They are often found with other crops on large estates. The chief essential oils furnished by these species are given below: —

Citronella oil is obtained by distilling "serchwangi-grass" (1) a grass mostly cultivated by the natives; 1 000 kg. of the grass yield about 7 kg. of the oil, which is mostly used in soap and perfume making (synthetic essence of roses). The chief producing countries are Ceylon and Java; Java produces by far the smaller quantity, but the product is of better quality and fetches twice the price of the other. The exportation of Javanese citronella oil to all countries was: — 1913, 75 230 kg.; 1914, 136 654 kg.; 1915, 233 326 kg.; 1916, 428 743 kg.; 1917, 515 763 kg. The largest importers are the United Kingdom, the United States and Japan.

Lemon-grass oil. — Produced from the grass of the same name (1), the yield being 0.2 %. At present importers prefer the oil from Cochin-China and Reunion.

Cananga oil. — Obtained by distilling the fresh flowers of the cananga (1), a tree that usually flowers twice a year, giving 60 kg. of flowers; to obtain 1 kg. of oil requires at least 350 kg. of flowers. This product is only exported in small quantities and it is not specially mentioned in official statistics; it has to compete with ylang-ylang oil from the Philippines, which costs 10 times as much (2).

(1) The cajuput is *Malacca leucodendron* L. "Serchwangi-grass", giving citronella oil, is *Andropogon Nardus*. Lemon grass is *A. Nardus* var. *Reuniosus* Hack. Cananga is *Cananga odorata* (see Note 2). The two Magnolias giving champaca oil are *Mickelia Champaca* L. and *M. longifolia*. Vitiver or cucus grass is *Andropogon muricatus* Retz. (Ed.).

(2) Ylang-ylang oil consists of the first fractions obtained in distilling the flowers of *Cananga odorata*; cananga oil is the whole product from distilling these flowers. (Ed.)

Champaca oil is obtained by distilling the flowers of two Magnoliaeae (1) common in India and which flower throughout the year; the oil yield of the flowers is about 0.2 %.

Vetiver oil is obtained from the roots of the vetiver or cuscus grass (1); the roots contain from 0.4 to 0.9% of essential oil; no official statistics as to its exportation are available.

Patchouly oil is obtained by distilling the stems and leaves of *Pogostemon Patchouly* Pell. The leaves can be gathered repeatedly, at intervals of 6 months. The east coast of Sumatra furnishes most of the supply; so far it is not specially mentioned in the official statistics.

Geranium oil is obtained by distilling the leaves of *Peiargonium* spp., the essential oil of which much resembles that of the rose. It is widely cultivated, especially in rubber plantations. During some researches it was found that 71 plants gave 76.5 kg. of leaves, which produces 53 cc. of essential oil containing as much as 58.8 % of geraniol.

1351 - **The Cultivation of Pyrethrum in Switzerland.** — FAES, H., in the *Schweizerische Apotheker-Zeitung*, Vol. XVI, p. 429, 1918, reproduced by HARVEY in the *Journal de Pharmacie et de Chimie*, Series 7, Vol. XVIII, No. 7, pp. 213-215. Paris, 1918.

The pyrethrum from whose flowers the insect powder is obtained is the *Pyrethrum cinerariaefolium* of Montenegro, Dalmatia, Herzegovina and Istria, which grows up to an altitude of 3,250 ft., and *P. roseum* and *P. carneum* of the Caucasus and Northern Persia, which grow up to 6,500 ft. Since 1912 the author has grown *P. cinerariaefolium* in Switzerland and it has quickly spread. At the end of 1917, 97 plantations were established, with a total of 24,800 plants. The dried flowers are now worth 11d. per lb. and the seeds 36s. 8d.

Sowing is done in April to May or in July to August with freshly-gathered seeds, in lines 8 in. apart; a mulch of leaves or fresh manure should be given, followed by watering and tilling. After 2 or 3 weeks the plants are already vigorous and they must be transplanted into warm, gravelly soil at a distance of 20 x 24 in.

The plantation begins to yield well after the second year. Flowering takes place in May. The flowers are all gathered in June, when most of them begin to open, and they are spread out in a shed in the shade to dry. The yield of dried flowers is 28 to 29 % of the fresh flowers. Flowers to be used for seed-production for extending the plantations are left on the plant until they have completely expanded (about July 15).

Experiments have shown that Swiss pyrethrum powder is quite comparable, as regards quality, to that from Dalmatia and Montenegro.

1362 - **The Production and Price of Orchil.** — *In-en Uitvoer*, Year III, No. 40, p. 89. Amsterdam, 1918.

Orchil, a dye extracted from various lichens (2), is used for imparting olive-green and brown shades to feathers, etc., especially ostrich feathers.

(1) See note on previous page.

(2) These lichens belong to the genus *Roccella* (*R. tinctoria* D. C.; *R. phycopsis* Ach; *R. fusciformis* D. C.). There are a number of substitutes for orchil, especially synthetic azo-compounds. (Ed.)

It is extracted chiefly in the United Kingdom, the lichens being imported from the Cape Verde islands. Of late years the United Kingdom has exported the following amounts to the United States. — 1914, 229,068 lb.; 1915, 372,803 lb.; 1916, 512,607 lb.; 1917, 209,383 lb. The increased exportation of orchil up to 1916 is due to the decrease in that of the German dyes; the increased in price to 6 1/2 d. per lb. in 1917 against 3.7 d. in 1914 is equally significative.

1363 — **The Production of Divi-divi in The Dominican Republic.** — MC LEAN, A., in *Commerce Reports*, No. 120, p. 708, Washington D. C., 1918.

Divi-divi is the commercial name for the astringent pods of *Caesalpinia coriaria* Wild, a leguminous shrub indigenous to the Dominican Republic. The plant is between 20 and 30 ft. high and bears white flowers; the fruit is a bean, about 2 in length, 1 in. in width, and about 1/4 inch in thickness; it contains about 30 % of a tannic acid used in the manufacture of leather. The bean ripens and falls to the ground from November to April; if it rains while the beans are on the ground they are ruined and large quantities are lost in this manner, as November and December are rainy months in this Republic.

Whole families of the poorer people devote their entire time to gathering divi-divi beans and bringing them to market. It is difficult to state the average yield per shrub; some produce as many as 70 lb. or more, and others of the same age yield only half that quantity. Almost all of the divi-divi shrubs in the Puerto Plata consular district are to be found in the arid lands on the Province of Monte Cristi. They are not cultivated, but grow wild over vast sections of the Province. The town of Monte Cristi, on the north coast near the Haitian border, is the centre of the industry and is the port from which most of it is exported. Divi-divi is usually packed for export in jute sacks weighing from 110 to 125 lb. gross. It was formerly shipped to some extent in bulk in sailing vessels, but this mode of shipment has been discontinued, as it was not found practicable. The value of this product is determined by its quality and appearance; large, plump and ruddy beans are in good demand, while small black and broken beans are unsalable.

The annual exports of divi-divi from Monte Cristi formerly exceeded 2,000,000 lb. but of late years they have fallen below these figures. This decline in the output is attributed to a species of orchid, which lives on the shrubs. This parasite reduces the production and often kills the plant. Nothing has been done to eliminate this pest, although it has spread at an alarming rate, so that there is hardly a shrub, which is not infested with it.

Prior to the war divi-divi was exported to Hamburg almost exclusively. The past few years, however, it has found a ready market in New York. The prices were formerly fixed in Hamburg at from 9 to 12 marks per 50 kilos (from \$0.0195 to \$0.026 per lb.), but now it brings from \$50 to \$55 a ton of 2,000 lb. f. o. b. New York.

1364 — Comparative Results of the Growth of *Hevea*, *Castilloa* and *Funtumia*

Rubber Trees at Tobago. — VERTEUIL, J. de (Superintendent of Field Experiments), in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Pt. 1, pp. 50-51 + 1 Table. Trinidad, 1918.

In 1907 five experiment plots were planted with alternate rows of *Hevea*, *Castilloa* and *Funtumia*. When the trees were four years old (in 1911) the different plots were subjected to the following treatments : — 1) manure ; 2) ammonium sulphate and potassium sulphate fertiliser ; 3) indigo as cover crop ; 4) mulched with grass ; 5) control.

As a result of the shade from the rubber trees it was impossible to grow the cover crop in 1914, and in 1915, manuring and mulching were no longer carried out regularly. The circumference of the trees was measured in 1911, before the plots were treated, and then regularly each year till December 1916. The results obtained for each species respectively in each plot are given in a table and lead to the following conclusions : —

The *Castilloa* grew most rapidly and the *Funtumia* most slowly. After manuring the annual growth of *Hevea* was superior to that of *Castilloa* and best in the plot with a cover crop. The *Castilloa* did best in the plot fertilised with ammonium sulphate and potassium sulphate, and the *Funtumia* in the control plot.

In short, *Funtumia* derived no benefit from the treatment of the plots, *Castilloa* no apparent benefit and *Hevea* a slight benefit. It should be noted that the soil of the various plots, of excellent quality, was far from exhausted by crops at the time the experiments were undertaken.

1365 — Effect of Grazing upon Western Yellow-Pine Reproduction in the National

Forests of Arizona and New Mexico, U. S. A. — HILL, R. R. (Grazing Examiner, in U. S. Dept. of Agriculture, *Bulletin No. 580, Contribution from The Forest Service, Professional Papers*, pp. 27 + 2 Figs. + 3 Plates. Washington, D. C., 1917).

The present bulletin gives the results of a study undertaken to determine the character and extent of the damage to young growth of western yellow pine in the southwestern United States due to the grazing of live stock, and to find out the best means of keeping such damage at a minimum while permitting proper utilisation of the range.

Of 8 945 trees of a size subject to grazing, observed over a 3-year period, 1 493 or 16.7 %, were severely damaged each year and 1 442, or 16.1 %, were moderately damaged. The most injured are the seedlings, 21 % of which are seriously damaged. The damage gradually decreases with an increase in the size of the trees. Trees above 4.5 feet in height are free from severe injuries from browsing, but those between 3 and 6 feet in height are likely to be rubbed severely.

The greatest amount of damage occurs during the latter half of June and the first part of July, or when the effects of the spring dry period are most pronounced. The least damage occurs during the first few weeks of the growing period, or before June 15. A very considerable amount of damage is done during the main growing season and during the autumn drying period.

Under normal conditions of grazing, cattle and horses, and inci-

dentally burros, do an inconsiderable amount of damage to reproduction. Sheep under the same conditions may be responsible for severe injury to 11 % of the total stand. On overgrazed areas all classes of stock are apt, however, to damage small trees severely. Cattle and horses may damage about 10 % of all reproduction. When sheep are grazed along with them, however, at least 35 % of the total stand may be severely damaged. Ordinarily sheep cause about seven and a half times as much damage as cattle.

The density of forage does not affect the amount of damage that may be caused on a given area. The suitability of the forage to the class of stock using a range has also an important influence upon the amount of damage to timber reproduction. Because of the suitability of the pure bunchgrass type to sheep grazing, the reproduction over approximately $\frac{1}{3}$ of the bunchgrass type on one National Forest is being seriously injured. The amount of palatable feed available during the grazing season, and especially during June and July, has also an important bearing upon the amount of damage that grazing will cause to reproduction. During a favourable year the damage may be 18 % less than during a subnormal year.

The manner in which stock is handled has much to do with the severity of grazing damage. Cattle are likely to injure 22 % of the trees between 3 and 6 feet in height that grow on areas where they are accustomed to congregate. Sheep severely injure reproduction along driveways and on bed grounds.

Grazing is believed to have a largely neutral effect upon the germination and early establishment of reproduction, but to have an important effect in reducing the destruction of reproduction by fire. The effect of grazing upon the height growth of reproduction is marked. Severely injured trees grow only from $\frac{1}{2}$ to $\frac{1}{3}$ as fast as uninjured trees. Grazing injuries are not responsible for the common deformities of mature trees.

It appears that the permanent effects of grazing injuries upon the development of damaged trees are not serious, provided they have a chance to recuperate. If grazing is unrestricted, about 15 % of the total stand is likely to be killed during the period required for reproduction to become established. Reproduction that has been impoverished greatly by grazing is more likely to be attacked by fungi and insects than uninjured and vigorous reproduction. However, the ordinary grazing injuries are not believed to increase seriously the danger of such attacks.

1366 - **National Parks in Spain.** — *Boletín de la Real Sociedad Geográfica, Revista de Geografía colonial y mercantil*, Vol. XV, Nos. 8-10, pp. 376-377. Madrid, August-October, 1918.

By the royal decree dated August 16, 1918, was founded in Spain, besides the National Park of "la Montaña de Covadonga" or "Peña Santa" in the Asturian-leon's Picos de Europa (1), the National Park of "Valle de Ordesa" or "río Ara", in the Arragonese Pyrenes.

(1) See also *R.*, June 1917, No. 556. (*Ed.*)

LIVE STOCK AND BREEDING.

1367 - **On Ocular and Locomotor Troubles in Equine Trypanosomiasis, in Morocco.** — VÉLU, H. (Research Laboratory of the "Service de l'Élevage"), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 566-568. Paris, 1918.

The author consider ocular and locomotor troubles and their respective importance in equine trypanosomiasis, in Morocco (1).

Ocular troubles (yellowish conjunctiva, sometimes congestion of the conjunctiva, œdemaous eyelids, often true conjunctivitis as well) are fairly constant, but they are not important as locomotor troubles. Nevertheless, ocular troubles can become much more serious in grave cases of rapid course: the eyelids are swollen, the eyes completely closed, there are tears of blood, and even keratitis is sometimes observed. The author quotes one of these serious cases which he had examined closely.

Locomotor troubles are, together with stupefaction, among the most constant symptoms, although they vary according to the animal and the intensity of the attack. They may be shown by slight difficulty in walking, unsteady trotting, as well as by being more evident, even showing paraplegia and an incomplete coordination of movement which may lead to loss of balance. Very evident locomotor troubles are, in addition, accompanied by incontinence of urine.

1368 - **On the Mortality from Trypanosomiasis of Dromedaries.** — SERGENT, EDMOND and ETIENNE, FOLEY, H. and LHERITIER, A. (Institut Pasteur d'Algérie), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 568-570. Paris, 1918.

The observations described by the authors are those on the first cases of trypanosomiasis of the dromedary ("debab") which could be controlled by laboratory methods during the whole of their duration. In 2 cases of natural infection the animals died after 4 months; in one case of infection by inoculation the animal seemed to have recovered in 18 months. The authors have also considered the part played by over-driving and by intercurrent diseases in the death of infected dromedaries and they have found that trypanosomiasis of the dromedary decreases its resistance to fatigue and privations (action of cold, fasting, heavy rain, etc.) and renders it much more sensible to other infections, which is a character very similar to malaria.

The authors state that amongst Algerian livestock, 10 % of the animals are usually infected with trypanosomiasis.

1369 - **Endoglobular Parasites of the Horse in Morocco.** — VÉLU, H., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 1, pp. 26-27. Paris, January 9, 1918.

Work carried out in the research laboratory of the "Service de l'Élevage," in Morocco.

In Morocco there are two equine piroplasmoses:—

1) true piroplasmosis, due to *Piroplasma caballi*, with haemoglobinuria, paresis, and sometimes paraplegia; 2) equine mottaillosis due to *Nyblia*.

(1) See also R., June 1917, No. 562. (Ed.)

tallia equi, of which the author has seen but one case, which ended fatally. In this case there was very strong jaundice and haemoglobinuria; three-fourths of the erythrocytes were parasitised at the moment of death and more than half of them contained two or more parasites.

1370 - **The Etiological Cause and Treatment of Granular Dermatitis of the Horse.**
— VAN SAGECHEM, R., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 575-578. Paris, 1918.

Some recent experiments of the author confirm his own previous observation that flies transmit the larvae of *Habronema*, the etiological cause of "summer sores". The author has further observed that the parasite found in the nodules of "summer sores" is a wandering larva of *Habronema muscae*. Larvae of *Musca domestica*, bred in the laboratory were placed in fresh manure from a horse known to be parasitised by *Habronema muscae*. The flies bred out from these larvae were found to be infested by *Habronema* larvae at the rate of 70%; the fly can only be infected during its larval stage. Observations on the *Habronema* larvae isolated from the flies enable the author to state that when placed on the dry skin or on the hair the larvae could neither move about nor pierce the skin, and so died quickly, and that they could only fix themselves at breaks in the continuity of the skin or on lubricated mucosa. Direct infestation by manure is thus very uncertain. The treatment may be prophylactic and curative.

PROPHYLACTIC TREATMENT. — This consists in fighting against *Habronema*, which lives in enormous numbers in the stomach of the horse. To destroy the adult form, administer arsenic at the rate of 1 to 2 gm. per day; to destroy the larval form, abolish the permanent litter and bury the fresh manure each day in the fermenting manure heap; the *Habronema* larvae, like those of flies, are killed by the heat developed in the manure; this is the biothermic method proposed by ROUBAUD (*Comptes Rendus Acad. des Sciences*, 1915, p. 325). It is obvious that combating the flies helps in fighting against the spread of summer sores, which must be specially protected in the hot weather by dusting the sores with some drying powder.

CURATIVE TREATMENT. — The author has obtained the best results by disinfecting the sore, then applying a powder composed of 100 parts of gypsum, 20 of alum, 10 of naphthaline, and 10 of quinine. The sores soon heal up if the plaster is kept renewed as long as there is any break in the skin.

In an additional note M. ROUBAUD says that the *biothermic method* suggested by him ought to be more widely used in veterinary hygiene; for the heat produced by fermenting horse manure can also be used for destroying the eggs and larvae of other parasites of the horse — oxyurids, ascarids, strongylids, etc. — present in the manure.

1371 - **The First Tests of Vaccination against Epizootic Lymphangitis.** — BOQUET, A., NEGRE, J., and ROIC, G., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 551-553. Paris, 1918.

By means of cultures of RIVOLTA's parasite, obtained recently, the authors have been able to carry out tests of preventive vaccination against epizootic lymphangitis (1), which previously was impossible as the crypto-

(1) See R., Sept. 1918, No. 1002. (Ed.)

coccus had not been cultivated in series. The method is based on the fact, discovered by the authors, that the serum of animals affected for more than 15 days, or cured, is rich in antibodies and that the natural or experimental disease confers immunity. The colonies of cryptococci, two months old, are ground in a dry state, emulsified in physiological salt solution, then placed in capsules which are heated at 62-64° C. for one hour. Four hypodermic injections of 5 cc. are given in the neck at intervals of 8 days.

The authors describe, as an example, an experiment made on 4 healthy horses treated by this method. The injections caused a slight oedema at the point of injection, followed, after its disappearance, by a slight hardening, but causing no open abscess. Eight days after the last injection, 2 horses were given, as a test, a hypodermic injection of 4 cc. of living cultures of cryptococci emulsified in physiological salt solution. The results were as follows: — the two vaccinated horses not inoculated with living cultures showed no symptom whatever of lymphangitis after 3 months; nor did the other 2 horses. The authors conclude that the vaccinated horses seem to have been immunised by the injection of heated cultures against the inoculation of living cultures of RIVOLTA's cryptococcus. They further add that the 4 horses vaccinated lived in the closest contact with gravely infected animals, and that these results show the possibility of vaccinating horses against epizootic lymphangitis by inoculation of sterilised cultures.

1372 — **Distomatosis and Glycosuria in Cattle, in Brazil.** — PARREIRA HORTA, P., in *A Lavoura*, Year XXII, Nos. 3 and 4, pp. 157-158. Rio de Janeiro, 1918.

In the course of his work on rabies the author found, some years ago, while doing post mortem examinations on cattle, the presence of a helminth often completely blocking the bile ducts and which was a large distomum now known as *Eurithrema pancreaticum*. Since then, when carrying out post mortems the author has always looked for this distomum and he states that there are few occasions when he has not found the parasite. Recently he also observed it in large numbers in the pancreas of a calf, thus showing that it can abundantly infest a young animal.

Seeing that these parasites are found in large quantities in the liver of animals suffering from glycosuria, the author suggests a relation of cause and effect between the two facts and throws doubt on the value of glycosuria as a diagnostic index of rabies, an index usually considered as quite sure.

1373 — **The Presence of the Virus of Rabies in the Spleen.** — REMLINGER, P., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 8, pp. 406-412 + 4 Tables. Paris, 1918.

In a series of inoculations of the spleen of a guinea-pig that had died from rabies into other guinea-pigs, the author found that the virus of rabies occurs much more often in the spleen than is generally admitted. The presence of the virus in that organ is completely independant from any post-mortem generalisation (1), as putrefaction is rather a hindrance to the diffusion of the virus of rabies in the spleen.

(1) See *R.* Oct., 1918, No. 1127. (Ed.)

1374 - **The Control of the Blow-Fly and the Sheep Maggot Fly in Queensland (1).** — *Queensland Agricultural Journal*, Vol. IX, No. 4, pp. 136-137. Brisbane, April, 1918.

I. — **BLOW-FLY TRAP.** — Mr. H. A. Adams, of Yalleroi, Queensland, has made a cheap trap for blow flies (*Calliphora* sp.) with a petrol tin. The tin is cut near the square upper end, on three of the vertical sides, then the upper part thus cut is bent over on the vertical side left intact; in this way an upper and a lower compartment are formed. In the lower half decomposed sheep's entrails are put as a bait and in the upper half a sweetened arsenical solution. Two strips of flannel, about 2 in wide are arranged so that they reach the bottom of the liquid and rest on the bait which is thus kept well poisoned. The bait must be well decomposed before using or the arsenic will prevent it from decomposing.

II. — **CONTROL OF THE SHEEP MAGGOT FLY (*Lucilia sericata*).** — The author (L. G. JONES) thinks that the dags where the fly usually lays her eggs, should be left on the sheep, instead of cutting them as is often done; the dags should be poisoned by submerging them in a very strong arsenical solution. The solution is prepared by heating $\frac{1}{2}$ lb. of washing soda in 4 gallons of rain water nearly to boiling point and then adding 1 lb. of commercial arsenic; it is then brought quickly to the boil, continuing for 15 minutes. As soon as the mixture is lifted off the fire, 4 pints of cold water are added and stirred well in, as after arsenic has been boiled in water it goes more completely into solution when suddenly put off the boil. The author is of the opinion that there is no advantage in using poisoned offal baits. It has even a contrary effect for, after a short time the fly leaves its natural medium — carcasses — and attacks the sheep. On the other hand the poisoned dags repel the flies, to the advantage of the sheep. In addition the sheep should have an arsenical sheep lick (4 parts of salt + 1 part of a mixture of $\frac{3}{4}$ of iron ore and $\frac{1}{4}$ of mispickel). All the arsenic would not be absorbed by the organism, and a part would pass out with the droppings, which would then be in such a condition as to retard greatly the development of the maggots. If the fly lays eggs on any part of the sheep's body other than the tail, it is because the yolk is diseased (damp, sticky and often badly smelling), the sheep being in bad health. In this case iron is a very appropriate medicine for sheep (2).

1375 - **On a New Disease of the Dog in Senegal.** — HECKENROTH, F., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 8, pp. 399-405. Paris, August, 1918.

The author records the appearance in Senegal of a special, and possibly new, disease of the dog. It is chiefly shown by nervous disorder ending

(1) See *R.*, 1914, No. 1017; *R.*, 1915, Nos. 401 and 1051; *R.*, 1916, No. 1205 (*Ed.*).

(2) Reduce to a fine powder and mix 1 part of iron-stone (containing chiefly a mixture of ferrous and ferric oxides) with 4 parts of mispickel; mix the whole with salt at the rate of 1 to 1 and give the stock free access to it in their troughs. This provides a good remedy against intestinal and blood parasites as well as an excellent tonic. The author made this discovery by noting that, in certain pastures of New South Wales the sheep themselves seek for the tickholes where the iron-stone occurs. Pastures where iron-stone occurs are among the most paying (L. G. JONES, a Natural Remedy for Worms and Blood Diseases in Stock, in the *Queensland Agricultural Journal*, Vol. IX, No. 2, pp. 48-51. Brisbane, February, 1918).

in death and, in some points, resembles rabies, of which the author suggests it may be an atypical case.

The symptoms observed and the results of the laboratory researches, directed especially towards the diagnosis of rabies, are described. NEGRI corpuscles in the horns of Ammor were sought for in four dogs but with negative results.

1376 — Description of a Bacterium which Oxidises Arsenites and of Another which Reduces Arsenates, Isolated from a Cattle-Dipping Tank in South Africa. — GREEN, H., in *The South African Journal of Science*, Vol. XIV, No. 11, pp. 465-467. The Cape, June, 1908.

A number of arsenic-resistant organisms have been isolated from a cattle-dipping tank. These include : —

1) *An oxidising organism*, changing arsenites to arsenates, causing deterioration of arsenical dips, and which seems to be the only one to which rapid oxidation of arsenites is to be ascribed. It has been provisionally named *Bacterium arsenoxydans*; its dimensions are variable (length 1 to 3 μ ; breadth 0.3 to 0.6 μ). It is easily differentiated from other organisms by its high tolerance to arsenite, the limit of tolerance being about 1 %. Under suitable conditions the rate of oxidation increases as the concentration of arsenite decreases.

2) *A reducing organism* which under normal conditions rapidly reduces arsenates to arsenites. This organism has been named *Bacterium arsenoducens* and appears to belong to the colon-typhoid family, from the other members of which it can easily be differentiated by its high resistance to arsenites. It is polymorphic, motile and of very variable dimensions (length 1 to 6 μ ; breadth 0.3 to 0.6 μ).

Other arsenic-resistant organisms have been isolated from the dipping tank. They neither reduce arsenate nor oxidise arsenite. Amongst these are members of the *putridum* group one of which, *B. fluorescens non-liquefaciens*, can grow freely in concentrations up to 1 % As_2O_3 as arsenite.

1377 — Elimination of Arsenic after Ingestion by, and Injection into, Live Stock, and After Absorption through the Skin by Dipping. — GREEN, H. H., in *The South African Journal of Science*, Vol. XIV, No. 11, pp. 472-473. The Cape, June, 1908.

Numerous experiments have been carried out to show the distribution of arsenic in the stomach and intestinal tract at various intervals after dosing and on its rate of elimination in the urine and faeces. The distribution of arsenic in the different compartments of the stomach of the sheep depends upon the path taken in swallowing. If the animal takes material voluntarily, as in the form of a lick, the greater proportion passes into the rumen, and thence slowly through the abomasum into the intestine. If the animal is forcibly dosed, a considerable part of the arsenic may pass direct to the abomasum, from which it is more rapidly passed on into the intestine.

Rate of absorption and elimination of soluble arsenic is rapid, and the path of elimination of either arsenite or arsenate of sodium is chiefly by the kidneys, about $4/5$ of the dose appearing in the urine, and only $1/5$, or less, in the faeces. After ingestion 25 % of the dose may be eliminated in the

urine within 24 hours, and as much as 60 % within 48 hours; later, the urine only contains traces. In the faeces the maximum output usually occurs in the third day, and by the seventh or eighth day the solid excreta are practically arsenic-free.

When soluble arsenite is injected straight into the blood stream the path of elimination is almost wholly through the urine. Elimination begins almost at once, and several per cent of the injected amount may appear within half an hour.

The data for horses and cattle are more limited. With the horse, however, the absorption of soluble arsenic appears to be less complete, and a large proportion is eliminated in the faeces. The amount of arsenic eliminated by cattle and horses after dipping in arsenical tanks is very small, and the currently accepted data are shown to be erroneous. Currently accepted data for arsenic retained in the skin of dipped animals are also shown to be too high.

1378 - Researches on the Utilisation of Inosite by the Animal Organism. — I. ANDERSON, R. J., Influence of Inosite on the Respiratory Quotient in the Dog, in the *New York Agricultural Experiment Station Technical Bulletin*, No. 54, pp. 39 + 4 Tables. — II. ANDERSON, R. J. and BOSWORTH, A. W., Influence of Inosite on the Metabolism of Man, *Ibid.* pp. 10-16 + 6 Tables. Geneva, N. Y., 1916.

I. — Inosite, discovered by SCHERER in muscle, has since been found in many animal and plant tissues. The author reviews the chief work done on the utilisation of inosite by the animal organism (KÜLZ, MAVER, STARKENSTEIN), which shows that a very small quantity of the inosite ingested is eliminated by the kidneys. In order to obtain further data on the subject, the author observed the influence of the ingestion of inosite on the respiratory quotient of the dog. The dog was fed with meat once a day together with 2 gm. of inosite per kg. live weight and was then at once placed in a respiration chamber. Under these conditions no noteworthy changes were observed in the respiratory quotient. In addition it was found that inosite is neither stored up nor oxidised, the greater part (about 77 %) being excreted unchanged mostly in the faeces and a small part in the urine.

II. — Results of observations relating to the influence of inosite on the metabolism of man. One of the authors took 10 gm. of inosite 3 times a day. It first acted as a purgative but, after a few days, the stools become normal. Here again, no sensible effect of the ingestion of inosite on the metabolism of man was observed, if it is not a greater excretion of creatinin which became manifest as soon as the subject ceased to take inosite daily. It was also found that, in man, a very small amount (9 %) of the inosite ingested is eliminated in the urine, while the faeces contain none at all. The authors have not yet been able to ascertain how the remaining 91 % is utilised in the organism.

1379 - The Dietary Qualities of Barley. — STEENBOCK, H., KENT, H. E. and GROSS, E. G. (Laboratory of Agricultural Chemistry, University of Wisconsin), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 61-74 + 20 Diagrams. Baltimore, July, 1913.

The authors studied the dietary qualities of barley with the help of

investigations similar to those used since the work of HOPKINS, OSBORNE and MENDEL, FUNK, and MC COLLUM, which have already been applied to various foods (1). Rats were used in the experiments. The food (barley in this case) was first ground to a coarse meal, dried for two hours at 70 to 80°C. and ground to a fine meal to which were added the usual supplements, casein, butter, fat, mineral salts, etc.

CONCLUSIONS. — Barley alone cannot satisfy the requirements of a growing animal, or even allow any noteworthy amount of growth. The addition of the fat-soluble vitamine (given as butter fat) remedies this defect to a certain extent, whereas casein has little effect. The addition of mineral salts gives better results. When all these supplements are added growth is normal. Barley contains the water-soluble vitamine in abundance, but neither sufficient fat-soluble vitamine nor sufficient protein (only 13.6%). Both of these, as well as mineral salts, must, therefore, be added to a ration consisting exclusively of barley, to allow normal growth.

1380 — The Cleaning and Crushing of Locust Beans and the Removal of their Kernels.

— COUR, R., in the *Journal d'Agriculture pratique*, Year LXXXII, No. 20, pp. 388-389. Paris, October 3, 1918.

The author points out that accidents often happen to animals fed on locust beans as a result of the formation of plugs in the digestive tract. For this reason the French Military Administration, when it introduced locust beans into the rations of army horses, ordered that the beans must first be cleaned, crushed and freed from their kernels, only 1 % being allowed to be left in. The food thus prepared was called "caroubine". During 18 months the author was in charge of the supervision and reception of this foodstuff which was sent to all the dépôts of the 15th District. Throughout this period no mishap was reported.

To test the possibility of introducing locust beans into the diet M. FOURCADE, Chemist of the Commissariat Laboratory, made a chemical analysis of them which gave the following results:— moisture 11.79 %; ash, 4.90; fat, 1.90; nitrogen, 23.62; starch, traces. This absence of starch in a seed is notable. There is no doubt that the kernel contains a special substance which causes the formation of plugs and may even have a paralyzing action on the peristaltic movements of the oesophagus. The irregularity of the effects leads to the supposition that this substance occurs in more or less large quantities according to the state of preservation, origin and variety of the locust bean. Grafted trees give pods much richer in saccharose and without the bitter taste of those from seedlings.

The author and M. ANDOUARD have had no opportunity of observing accidents to cattle through eating locust beans. These may be due to digestion by rumination. It is probable that, mastication being less complete (owing to the sharp, woody parts), cases of suffocation are rather more frequent than in horses. The cleaning and crushing of locust beans, and even the removal of the kernels, are advised, the expenses incurred being amply compensated for by the security obtained.

(1) See *R. Jan., Feb., March, April, May, June, July, 1918, Nos. 2, 62, 186, 316, 377, 347, 659, 662 and 782. (Ed.)*

1381 - **Value of Bulbs as a Cattle Food; Investigations in the Netherlands.** — EZENDAM, J. A., in *Verlagen van den Landbouwkundige Onderzoeken der Rijkslandbouwproefstations*, No. XXII, pp. 176-185 + 5 Tables + 13 Figs. The Hague, 1918.

Among the many vegetable products which have been used recently as cattle food there are many which, although their utilisation for such purpose is not new, have rarely been specially examined from the point of view of their food value. This is the case of bulbs, grown over 12 355 acres in the Netherlands in 1913. Under present conditions it was, therefore, natural to attempt to use these bulbs as cattle food, and to study their food value. The Royal Agricultural Station for the Control of Cattle Food at Wageningen made experiments on this subject. The following analytical results were obtained for bulbs of narcissi, tulips, hyacinths, gladioli and crocuses respectively : — Albumen 2.5, 3.8, 2.4, 3.0, 5.2 %; fat, 0.3, 0.2, 0.1, 0.2, 0.3 %; starch 29.6, 34.2 24.3 25.4 42.2 %; crude fibre, 1.8, 1.6, 1.0, 1.4, 2.5 %; moisture, 64.5, 59.2, 71.2, 68.7, 48.9 %; ash, 1.3, 1.0, 1.0, 1.3, 1.1 %. These figures show the bulbs to be comparable to potatoes, the average dry matter content of which is, however, only 25 %, whereas that of the bulbs is much higher, almost double in the case of the crocus. Supposing the digestibility of the starch of these bulbs to be 90 % as in the potato, the starch value on a dry matter basis would be : — narcissi bulbs 27.0, tulip bulbs 31.0, hyacinth bulbs 21.9, gladiolus bulbs 23.8, crocus bulbs 38.8. KELLNER placed the starch value of the potato at 19, so that, according to these data, the maximum price of the bulbs should be 1.42, 1.6, 1.15, 1.25 and 2.0 times that of the potato for the narcissus, tulip, hyacinth, gladiolus and crocus respectively. The food value of these bulbs, therefore, differs widely and is dependent especially on their dry matter content. The scientific literature gives little information on their practical use and most of the investigations on the subject are old. FROHNER (*Lehrbuch der Toxicologie für Tierärzten*, p. 156, 1890) says that *Narcissus pseudo-narcissus* and *N. poeticus* cause poisoning by an alkaloid, narcitine. As such poisoning has been observed in cattle, pigs and goats the unsuitability of narcissus bulbs as a food may be considered definitely established. There is also doubt as to the effects of hyacinth bulbs though when boiled they may be safely fed to stock. The same may be said of tulip bulbs which should be boiled several times renewing the water each time. Crocus bulbs which, according to KOBERT, contain saponin, may be fed to young pigs if small quantities are given at first and increased gradually; pigs may even be fattened by this process. There is little data on gladiolus bulbs, but the author has been unable to trace any record of evil effects following their use.

In times of shortage the use of these bulbs as a cattle food is worthy of attention if the above mentioned precautions are taken. As these precautions vary with the different kinds of bulb it is necessary to be able to recognise to what variety the bulbs belong or, if the food is composed of a mixture of bulbs, the material used must be known. To facilitate this the author gives for each species of bulb short indications on the shape and size of the starch grains, the position of the hilum, etc. Micro-photographs are also given.

1382 - **Crosses Between the American Bison, the European Bison and Domestic Cow Made in the Zoological Garden of Askania-Nova (Government of Tauride, South Russia) (1).** - IVANOV, E. and PHILIPPSCHENKO Jur. (Zootechnical Station of the Veterinary Service of Askania-Nova), in the *Zeitschrift für induktive Absammlungs- und Vererbungsforschung*, Vol. 16, Pt. 1-2, pp. 1-48 + Figs. Leipzig, 1916.

During the summer of 1913, the authors studied the crosses made by M. F. E. FAIZ-FEIN between the American bison (*Bison americanus*), European bison (*Bison bonasus*) and the domestic cow in his zoological garden at Askania-Nova; there were then 25, the most typical of which were described, with figures and measurements.

CROSSES BETWEEN AMERICAN BISON AND EUROPEAN BISON. - According to the authors such crosses have not been previously made save at Askania-Nova. There were adult hybrids (2 5-year old males and one 4-year old female, "Sanka"), produced from a male European bison and a female American bison. In 1911, the female "Sanka" was mated with a European bison, and produced a heifer calf in 1912. Next crossed with a American bison \times European bison hybrid, she gave, in 1913, a bull calf. This represents the F_2 generation of the cross between American and European bison. The progeny of the female "Sanka" are still too young to be used in the research.

The American \times European bison hybrids have, as regards their exterior a form intermediate between that of their parents. The head, as regards the hair and fringe on the throat resembles that of the American bison rather than that of the European one. The hump is smaller than in the American bison and its sweep to the head is less stiff and is more similar to the European bison. The resemblance of the animals to the European bison holds good also for the hind-quarters. The tail is of intermediate development. On the contrary the colour is like that of the European bison. As regards size and development the hybrids equal or surpass their parents. If their characters remain constant in future generations (which is not yet certain), the authors think these forms would have to be considered as a new species, which they propose to call *Bison felzfeini*, in honour of the breeder.

CROSSES BETWEEN AMERICAN BISON AND DOMESTIC COW. - On crossing a male American bison with a domestic cow, 2 males (now aged 14 and 13 years) were produced in the first generation as well as 2 females (13 and 11 years). As the 2 males ("Mischka" and "Selifon") were sterile they were castrated. The females ("Staraja" and "Podpalaja"), however, were fertile and on crossing either with American bisons or domestic bulls calved each time.

Of the two half-blood males, the authors only studied "Mischka", a typical intermediate form between American bison and domestic cow. The head, with a beard, strongly resembles that of the American bison. The tuft of hair at the lower part of the chest is also characteristic. The front legs have long hairs falling down to the knees. The horns are, however, like those of the mother (grey breed from the Ukraine steppes). The hump

(1) See also *R.*, June 1914, No. 64* (Ed.)

is less pronounced than in the American bison, but is of the same type. The back and hindquarters are very like those of the American bison; the tail, intermediate between that of the American bison and that of the domestic cow, is shorter than in the European bison. The skin is of a dark colour.

Amongst the half-blood females, one ("Steraja", obtained by the cross American bison \times grey cow of Ukraine steppes) well shows the type intermediate between the parents, although its characters are less marked than in the male progeny. This animal resembles an ordinary cow much more than its brother does an ordinary bull. The head, which is bearded, resembles that of the American bison; the chest has a tuft of hair. The horns are those of the domestic cow. The thorax is shaped generally like that of the cow, and the hump is not pronounced. The hindquarters recall those of the American bison; on the contrary the tail is more like that of the cow. The colour is dark.

Another half-blood female, "Podpalaja", is clearly different from the preceding one, for it is the daughter of another American bison and a Short-horn cow. It resembles the cow much more than the first, especially in the head. The beard and the tuft of hair on the chest are not much developed; the animal has a hump. The general colour is black, with white splashes on the belly and lower chest. HENSELER's observation that, in crossing Shorthorns with various wild forms (gayal, yack, etc.) the stripes sometimes seen in Shorthorns appear, has not been confirmed in this case.

The half-blood female, "Staraja", crossed with an American bison gave a heifer calf, "Slepaja", which is a $\frac{3}{4}$ blood female bison. This animal is more like a female American bison than a cow. The head is that of the American bison, the neck and beard are strongly developed; the lower part of the chest had a heavy tuft of hair. The horns have, like these of the $\frac{1}{2}$ -blood forms, the characters of the horns of the domestic cow. The hump is small and the hind-quarters resemble those of the bison. The colour is like that of the American bison but is lighter on the hindquarters.

On crossing the half-blood female "Podpalaja" with a Shorthorn bull a female ("Belaja") was obtained with $\frac{3}{4}$ Shorthorn and $\frac{1}{4}$ American bison blood. This animal so closely resembles the ordinary cow that its hybrid character cannot be determined at first sight. White colour. The only characters recalling the grandfather (American bison) are the hump and the tuft of hair on the lower part of the chest.

As regards temperament, all the hybrids (including the $\frac{3}{4}$ Shorthorn cow) resemble the American bison most.

CROSSES BETWEEN EUROPEAN BISON AND DOMESTIC COW. — A half-blood male ("Herkules"), son of a European bison and a grey Ukraine cow, was sterile, and so was castrated, like the half-blood American bisons. It resembled the European bison much less than the half-blood American bisons do the American bison. The head is that of the cow but it has a beard and there is a tuft of hair on the chest. From the length and shape, the horns are of the bovine type. There is a hump, but it is smaller than in the European bison. The general constitution and colour make it an intermediate form between European bison and Ukraine cow.

A half-blood female ("Galka"), out of another European bison and another grey Ukraine cow, shows similar characters, and resembles rather the domestic cow. The head is that of the cow and the horns are those of the Ukraine cow. From the father are derived the beard and tuft of hair on the chest. The body is similar to that of the cow, but there is a well developed hump. The animal is coloured like the mother.

Another half-blood female ("Dunja"), out of a European bison and a grey Ukraine cow, has similar characters, but on account of the animal's youth they are less pronounced. The colour is not grey, but black.

The half-blood female "Galka" crossed with a European bison gave a bull calf ("Otboj") with $\frac{3}{4}$ European bison blood. Allowing for its small size and other characters showing mediocre development, it is fairly distinct from the half-blood forms; it is most like the European bison. Both head and chest are very hairy, and the horns are of the cow-type. The hump and hind-quarters completely recall the European bison, while the colour is more like that of the cow. On the whole, this male resembles a European bison most.

A $\frac{3}{4}$ blood female ("Golubka"), out of the $\frac{1}{2}$ -blood female "Galka" and another European bison, has the same characters as the male "Otboj", but temperament, horns and colour are most like those of the European bison.

"TRIGENOUS" HYBRIDS BETWEEN EUROPEAN BISON, AMERICAN BISON AND DOMESTIC COW. — These are the progeny of the half-blood females (whose father was an American bison and mother a cow) crossed with a European bison. The males have not yet been used for reproduction, but they should be fertile as the sperm of one male contained normal spermatozoa. The females are certainly fertile. The authors describe some of the hybrids.

The male "Bjelmordij" differs from the half-blood American bison and the half-blood European bison by many characters. The head and strongly hairy coat recall the wild American bison, but in most of the characters it resembles the European bison. The beard and tuft of hair are as well developed as in the European bison, but the front quarters are less hairy than in the two species of bison. The horns are like those of the cow; the colour is dark, as with the European bison. This is a most original form, which most resembles the European bison (not as much, however, as the $\frac{3}{4}$ -blood male "Otboj"), but showing a notable maternal influence.

Another male, "Pctjka", is very similar to the previous one, but is smaller. The difference is seen in the fore-quarters (nape, neck, chest) which are more like those of the cow.

In a third male, "Dubass", the characters are the same as in the previous one; the hair of the head and fore-quarters most resemble those of the male "Bjelmordji".

Another male, "Martin", has characters very different from the previous ones. The hair on the body and fore-quarter is less developed, the horns smaller, but the hump is bigger and the tuft of hair is longer. As this animal is still young, some of its characters may change in time.

A female, "Lyssa", has, like all the females, less hair on the head,

so that it is more like an ordinary cow. The beard and tuft of hairs on the chest are well developed, however, and the horns resemble those of the European bison. On the whole, the characters incline more towards those of the European bison.

The author describes a "trigenous" female ("Tschubataja") which does not contain $\frac{1}{4}$ cow's blood like the previous ones but $\frac{1}{8}$. The head is, broadly speaking, like that of a female produced by the cross American bison \times European bison. The horns are just like those of the American bison. The lower part of the chest and the upper parts of the fore-quarters are very hairy. The tail is like that of the European bison but is shorter; the part between the root and the tuft has the character peculiar to crosses between American bison \times domestic cow. On the whole, the female "Tschubataja" mostly resembles, not the pure blooded European or American female bison, but the female "Sanka" given by the cross American bison \times European bison. As "Sanka" has $\frac{1}{2}$ American bison blood and $\frac{1}{2}$ European bison blood and "Tschubataja" has $\frac{1}{2}$ American bison, $\frac{1}{8}$ European bison and $\frac{1}{8}$ domestic cow, the resemblance of the two hybrids is easily explained.

In conclusion, the authors give measurements of 12 crosses (American bison \times cow, European bison \times cow, "trigenous" hybrids), but give the warning that they are not all reliable.

1383 - Comparative Yield of Cattle Before and After Fattening. — GOUIN, A. and ANDOUARD, P., in the *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Year IV, No. 1st, pp. 556-557. Paris, 1918.

Under ordinary conditions the new-born calf requires less than 30 months to attain a weight of 500 kg., after utilising 2600 kg. of food material.

The 500 kg. live weight does not represent more than 185 kg. of food stuffs, protein and fat, the surplus consisting mainly of water. The proportion of fat is then about 8%, or 40 kg. out of the weight of 500 kg.

If the animal is fattened, suitable foods being available, the live weight should be increased from 500 to 600 kg. in 100 days, with a minimum of 25% fat, or a total of 150 kg.

The 110 kg. (150-40) of fat thus gained required the following food material: —

| | |
|---|-------------------|
| 1) Material forming the fat, 100 kg. \times 2.27 | 249.7 kg. |
| 2) Work expended in forming the fat, of a value equal to twice that of the food. | 499.4 kg. |
| 3) Maintenance of body for 100 days; average weight of 550 kg. corresponding to a surface area of 6.49 sq. decimetres | 324.5 kg. |
| <i>Total . . .</i> | 1073.6 kg. |

The daily food requirement is equal to 1.05% of the body weight; which agrees with the figures of the German school.

Thus, the unfattened bullock provides 185 kg. of food material for

human consumption, after consuming 2600 kg., while the fat bullock gives nearly 250 kg. more, against a consumption of 3674 kg. of the same foods.

Fattening increases the yield of the animal by 135 %, while the cost of its food only increases by 40 %.

1384 - An Experiment in War Time Beef Production, in Great Britain. — WOOD, T. B., in *The Journal of the Board of Agriculture*, Vol. XXV, No. 5, pp. 549-560 + 1 Table, London, August, 1918.

The experiments described were undertaken to determine the minimum amount of cake required for winter beef production. The only previous direct experiment on the subject is one carried out at the Norfolk Agricultural Station in 1908, when 10 steers on a ration of 1 $\frac{1}{2}$ cwt. of roots, 10 lb. of chaff and 1 lb. of cotton cake per head per day, gained 1 $\frac{1}{4}$ lb. in live weight per head daily for 20 weeks. During this period they produced 78 tons of dung of good manurial value.

The trials were carried out at two stations in Norfolk (Norfolk Agricultural Station, Little Snoring and Field Dalling), two stations in Scotland (Spencerfield and Craibstone), and three stations in Ireland (Ballyhaise, Athenry and Glasnevin). Two and a half year old steers were fed on as many roots and as much straw as they would eat, supplemented with only 1 $\frac{1}{2}$ lb. per head per day of undecorticated cotton cake. Where possible the weights of litter consumed and of dung produced were recorded, and the animals slaughtered under such conditions that their carcass weights could be determined. Beyond these points the ordinary practice of the district in which the experiment was made was adopted, so that, though the method of feeding did not agree in every detail, the results show the increase in live weight which may be made by 2 $\frac{1}{2}$ year old steers on a cake ration of 1 $\frac{1}{2}$ lb. when the rest of the ration varies according to local practice.

Five of the results were extraordinarily uniform, showing an increase in live weight of from 8 to 10 lb. per head per week. In two cases (Norfolk Agricultural Station and Athenry) this rate was greatly exceeded (17 lb. and 15 $\frac{1}{2}$ lb. respectively) possibly, in the first case, because a fair ration of good, long hay was given. At Glasnevin the rate of increase was much smaller (5 $\frac{3}{4}$ lb.), possibly an account of the small ration of roots. On the whole, the experiments showed that with a liberal allowance of roots and either good oat straw or hay, supplemented by 1 $\frac{1}{2}$ lb. of cake per head daily, an average increase of about 1 $\frac{1}{4}$ lb. per head per day may be relied on in the case of good quality steers of 2 $\frac{1}{2}$ years or more. It is not yet known whether younger animals would give similar results. In 15 to 20 weeks the animals will yield about 56 % of dressed carcass, which entitles them to be placed in the first grade. If kept in covered yards they will produce about 7 tons of dung per head during the feeding period.

The results leave no doubt that beef may be satisfactorily produced if the animals are given 1 $\frac{1}{2}$ to 2 cwt. of cake. The yield of meat will probably be within 10 % of the yield obtainable with a normal ration of cake. The Scotch results suggest that beef can be produced from roots and straw with no cake at all, but the yield of meat will probably be reduced by a

further 5% (a total of 15%) below the yield obtained with a normal ration of cake.

The financial statements given show the cost of the stores, which amounted to 70% of the cost of the finished animal, to be by far the largest item in the total cost of beef production. If, therefore, stores can be bought at a reasonable price, say at 5s. per live cwt. below the selling price of beef, economic feeding should result in the production of dung at a reasonable price. The food is the next most important item and amounted to nearly 24% of the total cost of production even with the low cake ration used. Labour and litter amounted to about 3% each. Though, from an economic point of view, it is desirable to economise in food and labour, by far the most important point is to economise in buying the stores, which should cost at least 5s. per live cwt. less than the price at which the finished animals will be sold.

1385 — "Woolless" Sheep as Butcher's Animals in Cuba. — DE CASTRO, R., in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No. 8, pp. 435-436 + 2 Figs. Havana, August, 1918.

The author thinks that sheep rearing in Cuba should be intensified so that a more abundant supply of meat may be rapidly obtained and to profit from the many uncultivated or uncultivable areas still existing in the island. But as the wool breeds usually reared suffer either from the heat or ticks which hide in the fleece the author suggests the use of "Woolless" or "Barbadoes" sheep, originating in Africa, acclimatised at Barbadoes (Antilles) and introduced from thence into the United States. This breed is quiet, hardy, strong, and very prolific, since it lambs all through the year, producing from 1 to 5 lambs. They have no horns and the skin is covered with coarse, slightly wavy hairs. They seem excellently suited to warm climates. At Porto Rico they have given good results; in the experimental station of the island they have been crossed with the native wool breed, which is selected for meat production, and crosses have been obtained, in the majority of which the characters of the native race prevail, except for the fleece, which was absent.

1386 — Substitutes in Swine Feeding, in Canada. — I. ROTHWELL, G. B., Economical Substitutes in Swine Feeding, in *The Agricultural Gazette of Canada*, Vol. V, No. 5, pp. 440-446 + 2 Plates. Ottawa, May, 1918. — II. TRUEMAN, J. M., War-time Hog Rations, *ibid.*, p. 470 + 2 Tables.

I. — For several years numerous experiments in the feeding of pigs have been carried out at the Central Experiment Farm, Canada, and the paper under review gives a summary of the results obtained which may suitably be adopted under the food-shortage conditions brought about by the war.

Cottonseed meal, gluten feed, linseed oil meal and distillers' grains may possibly be obtained, though only in limited quantities. They give good and economical results when added to a basis maize, shorts, barley ration in the following proportions: — gluten feed 20%, linseed oil meal 17%, cottonseed meal 13%. Good results were also obtained with 20% of distillers' grains. An increase in the percentage of linseed and cottonseed

meal added causes protein poisoning, though as much as 30 % of gluten feed may be given. Maize oil cake, when procurable, is an excellent concentrate fed with shorts, or bran and skim-milk. Maize bran may be profitably fed to brood sows or fattening hogs, but not in quantities exceeding 20 %. Consistently good results were obtained with buckwheat screening which, when fed with skim-milk proved about equal to a standard ration of maize shorts and oil-cake.

It is not possible to vary very greatly the normal rations of young pigs. Skim-milk appears to be almost a necessity and cannot really efficiently be replaced by any other food. Tankage may, however, be regarded as a milk substitute. The best results were obtained when pigs were weaned without milk by supplying meal dry in a self-feeder, part of which was partitioned off and filled with dry tankage which was consumed as required. Water was freely supplied. The chief value of tankage is as a balance to grain. Middlings for the young pig may be replaced by 70 % shorts, 20 % maize meal and 10 % oil-meal. With this, milk in some form is the one best food.

Feeding cut green crops to pigs is not advantageous on account of the labour it involves, and the fact that the feed soon becomes uneatable owing to exposure to the sun and soiling by the pigs, so that much waste occurs. Great advantage is, however, derived from pasturing. As a single pasture crop, alfalfa is unexcelled, though clover is almost its equal. Good results have also been obtained with rape as well as with heavy seedlings (3 to $3\frac{1}{2}$ bushels per acre) of barley, oats, or wheat. Of the cereals sown singly barley is the best pasture crop and, though a mixture of equal parts of barley, oats and wheat gives very good results, it is inferior to barley alone. A summer pasture of alfalfa, clover, or a spring-sown grain or grain mixture is a cheap self-harvested feed for growing pigs. Late summer and autumn pasture should be supplied by rape. An acre will pasture from 10 to 15 hogs in the growing season. An experiment showed the cost per 100 lb. gain to be reduced from \$5.30 in paddock feeding to \$3.54 in pasture feeding.

Skim-milk is the best single food for the growing hog, but buttermilk, fed fresh, is its equal. For a hog of 60 lb. or over, 400 lb. of skim-milk is equal to 100 lb. of meal. Whey also gives satisfactory results and, if fed fresh, 100 lb. will replace 19.2 lb. of meal. Skim-milk should not be over-fed. With young pigs the best results are obtained with 1 lb. of milk to 2.5 or 3 lb. of meal; for a 100 lb. or more hog not more than 5 lb. should be fed daily. Milk should be fed sweet to very young pigs, but later there is little difference between sweet and sour milk so long as one or the other is fed consistently. Buttermilk and whey should be fed fresh.

Except in the case of the young pig, feeding twice daily is preferable to three times. Economy is effected by the use of a well-designed self-feeder; a combination of pasture, or successive pastures, with milk by-product and grain self-fed is specially recommended. During the pasture season if grain is self-fed 1 acre of land will carry an average of 4,000 lb. live weight of hogs. A series of experiments made in 1917 gave the following results for meal and milk trough-fed, meal and milk self-fed, meal and tank-

age self-fed, respectively:— Average daily gain, 0.85 lb., 1.05 lb., 0.53 lb.; meal eaten per lb. gain, 1.51 lb., 1.79 lb., 3.9 lb.; skim-milk per lb. gain 5.2 lb., 3.1 lb., —; cost per lb. gain 4.8 c., 5.3 c., 10.1 c.

II. — For three years the Nova Scotia Agricultural College has made experiments in feeding pigs on grain, skim milk and mangels. The results showed that gains can be made with a comparatively small amount of grain and with less total digestible nutrients than when grain is fed alone. The tables given show that 100 lb. of gain was made with an average of 148 lb. of grain, 900 lb. of skim milk and 110 lb. of mangels, containing 201 lb. of digestible nutrients. Quite a small amount of feed was given when the pigs were only 6 weeks old, but when they neared the age of 24 weeks (200 lb. or over) they consumed as much as 4 lb. of grain, 15 lb. of skim-milk and 4 lb. of mangels per day. The average daily consumption between the ages of 6 weeks and 24 weeks was 2.2 lb. of grain, 12.9 lb. of skim-milk, 1.6 lb. of mangels.

1387 — *Fish Meal as a Feed for Swine (1).* — ASHBROOK, FRANK G., in the *U. S. Department of Agriculture, Bulletin No. 610*, pp. 1-9. Washington, December 7, 1917.

The value of fish meal as a feed for pigs has been recognised for some years past, especially by Germany, which used it for this purpose to a far greater extent than any other nation. The experiments described were carried out at the Bureau of Animal Industry Experimental Farm, Beltsville, Md. to compare the value of fish meal and tankage as supplementary rations and to test the value of fish meal as a supplement to dried potato.

1. — *Comparison of fish meal and tankage as supplementary rations.* — Twelve grade Berkshires of uniform size, age, and breeding were used. The experiment was divided into two periods, a growing period of 112 days from weaning to fattening age, and a fattening period of about one month. The pigs were about three months old at the beginning of the experiment.

During the growing period the pigs were divided into two lots — 1 and 2 — of 8 and 4 pigs respectively. Lot 1 was fed 4 parts maize meal, 4 parts middlings and 1 part tankage, and Lot 2, 4 parts maize meal, 4 parts middlings and 1 part fish meal. Lot 2 made a greater daily gain per pig (1.31 lb.) than did Lot 1 (1.25 lb.), and at the end of the experiment the average difference in weight was 10 lb. in favour of fish meal. Lot 1 ate slightly less grain per pig daily (4.53 lbs.) than Lot 2 (4.80 lb.). There appeared to be no difference in growth or general development between the two lots, showing that there was little to choose between the rations.

During the finishing period the same 12 pigs were divided into 3 lots of 4 animals and fed as follows:— Lot 3, 4 parts maize meal, 4 parts middlings, 1 part fish meal; Lot 4, 9 parts maize meal, 1 part fish meal; Lot 5, 9 parts maize meal, 1 part tankage. Lot 4 made the highest daily gain per pig (2.16 lb.), Lot 5 the next highest (2.00 lb.) and Lot 3 the lowest (1.91 lb.). The grain consumed per 100 lb. gain was:— Lot 5, 462.00 lb.; Lot 3, 421.00 lb.; Lot 4, 393.00 lb. It will be seen, therefore, that the best results were obtained with 9 parts maize meal + 1 part fish meal.

(1) See also *R. Dec.*, 1916, No. 1301; *R. June*, 1917, No. 565, (Ed.)

2. -- *Fish meal as a supplement to dried potato.* -- Twelve high-grade Berkshire pigs between 5 and 6 months old were divided into four lots of three pigs and fed the following rations: — Lot 1 (check lot), 6 parts maize meal, 1 part tankage; lot 2, 6 parts dried pressed potato, 1 part tankage; Lot 3, 6 parts dried pressed potato, 1 part linseed oil meal (old process); Lot 4, 6 parts dried pressed potato, 1 part fish meal. The average daily gains were: — Lot 1, 1.57 lb.; Lot 4, 1.32 lb.; Lot 3, 0.91 lb.; Lot 2, 0.80 lb. The rations fed per 100 lb. gain were: — Lot 1, 403 lb.; Lot 4, 428 lb.; Lot 3, 584 lb.; Lot 2, 695 lb. The most rapid and economical gains were made with 6 parts maize meal + 1 part tankage, though those made with 6 parts dried potato + 1 part fish meal were not much inferior.

At the end of the experiment the heaviest animal from each lot was killed to determine the quality of the flesh and fat and the degree of finish. In no case did the meat have any fishy smell or taste.

These results show that, where it can be obtained at a reasonable price in suitable quantities, fish meal, if used in proper proportions, should become one of the most popular and economical supplements for feeding pigs.

1388 — **The Part Played by the Egg Shell of the Hen in the Formation of the Chicken's Skeleton During Incubation.** — DELPEZNE, C. and FOUCNEAUX, E., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 9, pp. 413-429 + 7 Tables. Paris, 1918.

It is known that the fresh hen's egg contains little lime (CaO), usually not more than 35 mgm. for an egg weighing 60 gm. It may, therefore, be asked: — 1) how can the chick form its skeleton with so small a quantity of lime; 2) if the chick contains more lime than was present in the interior of the egg during incubation, whence has it obtained it? A review of the chick work done on the subject (PROUT, GOBLEY, VOIT, PREYER, VAUGHAN and BILIS, TANGL) show how greatly the opinions vary as to the part played by the egg shell in the formation of the chick's skeleton; some refuse to admit it, while others take it as proved.

Owing to these diverging opinions, the authors have reopened the question. They have estimated the lime in the contents of a large number of eggs. These, placed in an incubator, were removed successively on the 10th and 12th day of incubation (when ossification of the skeleton begins), then regularly each day from the 14th to 21st day (hatching). To control the results the authors used eggs other than these of the hen, such as duck and peahen. The results, given in tables, show: — 1) the weight of the fresh egg; 2) the lime in the contents of the egg on the day of sampling; 3) the lime in proportion to 100 gm. of whole egg weighed at the moment of laying; 4) for certain samples, the total percent of phosphorus in the entire egg.

The results are very clear and lead to the following conclusions: —

1) The lime in the content of the egg increases about 500 % during the whole time of incubation. This increase begins to be traceable about the 10th and 12th day of incubation, is very marked about the 16th and 17th days and then continues regularly until hatching.

2) In the unfertilised hen's egg put to incubate, the % weight of lime

after 21 days is the same as in the fresh egg ; no trace of lime passes from the shell to the interior of the egg.

3) In peahen eggs, the increase in the lime content during incubation was 500 %, while, in duck eggs, it was slightly below 400 %.

4) The phosphorus does not increase during incubation.

These experiments clearly show that the physiological role of the egg-shell of birds consists in supplying the embryo with a lime reserve, which the embryo utilises during incubation in a way as yet unexplained. But it may be said that "the modifications undergone by the vitellus and albumin during incubation take place in a regular rhythm, during which a substance is freed in determined amounts and which has the power of dissolving a determined amount of the lime of the shell".

This substance might be an acid, a sugar, or allantoin. But the authors think that the solution may be obtained by a minute analysis of the amniotic liquid, which, in fact, about the 17th day of incubation, at the moment when the solution of the lime increases, is alone in contact with the shell through the egg membrane.

1389 - *Final Report of the Fourteenth Egg-Laying Competition Held at the Queensland Agricultural College, Gatton, from April 1, 1917 to March 31, 1918* (r). — *Queensland Agricultural Journal*, Vol. IX, Pt. 6, pp. 213-225 + 10 Figs. Brisbane, June, 1918.

In the 14th competition 438 birds competed, 318 in groups of 6 and 120 singly. The advantage of this last method was again confirmed and the group system must be considered obsolete. The weather conditions were very unfavourable and the quality of the food poor. The hens showed a strong tendency to brood, perhaps as a result of the continual wet weather. In short, the results were not very satisfactory. The average yield per hen was the lowest yet recorded in the Gatton competitions. The total was 83,868 eggs or 191.5 per hen in one year. The maximum yield from the light breeds, represented by White Leghorns only, was 1652, or 275.3 per head. The first place among the heavy breeds was taken by Black Orpingtons with 1470 eggs or 245 per hen. Two new records were made — one Black Orpington laid 335 eggs in 365 days and one group of six White Leg-

(1) For the results of the competition held from April 1, 1913, to March 31, 1914, see R. 1915, No. 82. In the competition held from April 1, 1914 to March 31, 1915, for which were entered 240 hens, including 102 White Leghorns, 51,202 eggs, or an average of 226 per hen, were laid throughout the year. The first three groups of 6 hens gave 1545, 1544 and 1534 respectively. Only four groups gave less than 1200 each (*Queensland Agricultural Journal*, Vol. III, Pt. 6, pp. 244-244. Brisbane, June, 1915). In the competition held from April 1, 1915 to March 31, 1916, for which 53 groups of 6 hens (318 hens) were entered, the total number of eggs laid was 70,848, or an average of 222.8 per hen. The first three groups (White Leghorns) gave 1530, 1530 and 1481 eggs respectively. Only six groups gave less than 1200 eggs. These competitions showed the light Mediterranean breeds to lay best. In competitions they should, therefore, be separated from the less active large Asiatic breeds. The necessity of breeding hens with a view not only to their laying capacity, but also to their general vigour and trueness to type was likewise shown. (*Ibid.*, Vol. V, Pt. 6, pp. 316-322. Brisbane, June, 1916). (Ed.)

horns laid 1661 eggs, or 277 per hen in one year. In both cases the birds were disqualified for prizes because the eggs were below the standard of 24 oz. the dozen. The competition showed the necessity of not sacrificing the size of the egg to the size and vigour of the hen and, consequently, to fertility.

The food consumed by the 438 hens throughout the year was: — wheat 266 bus., maize 42 bus., hulled oats 15 bus., skinless barley 9 bus., pollard 420 bus., bran 196 bus., oilcake 4 cwt., desiccated meat 2 cwt., bonemeal 1 $\frac{1}{2}$ cwt., dried blood 4 $\frac{1}{2}$ cwt., green lucerne, and soup meat.

1390 — **The Artificial Feeding of Bees with Pollen.** — USAY, J., in the *Illustrierte Monatsblätter für Bienenzucht*, Year XVIII, No. 5, p. 35. Vienna, 1918.

It is known that in spring bees use a large amount of pollen for feeding the hive. As, in many countries, flowers are rare at this period and the workers are impeded by the bad weather, the author advises the provision of pollen for the bees. This was suggested to him by the fact that many beekeepers spread in front of their hives flour, which is eagerly gathered by the bees. At the flowering season of resinous trees, which produce abundant pollen, the author shook cones over a box cover, thus obtaining an abundant supply of pollen, which he kept in a dry room till the following spring. When this dust is spread on a board in front of the hive in fine weather the bees immediately collect it. The author has observed no ill effects as a result of this food.

1391 — **The Creation of an Interministerial Silk Committee, in France.** — *Journal Officiel de la République Française*, Year L, No. 262, p. 8417. Paris, September 26, 1918.

By the decree of September 20, 1918, there was created in France an Interministerial Silk Committee controlled by the Minister for Commerce and composed of 21 representatives of the various Ministries as well as of the silk trade and industry.

Its functions are (art. 1): —

- 1) To suggest, centralise, co-ordinate and indicate measures for assuring to France a supply of silkworm eggs, raw silks, worked silk, silk by-products and articles made in silk;
- 2) To establish, in agreement with those using silk in its different forms, and with traders and manufacturers interested, those products that should be given priority and to indicate the relative urgency;
- 3) To indicate measures to be taken to provide for such needs according to the orders of priority;
- 4) To carry out the same study and exercise the same control for artificial silk;
- 5) To suggest any other action that may be required.]

1392 — **Influence of the Breed of the Eggs on the Cleanliness of Raw Silk.** — FUJIMOTO, J., in the *Bulletin de l'Association sericole du Japon*, Year III, No. 1, pp. 1-4. Tokio, April 15, 1918.

For a long time Japanese silk has been criticised for its too large number of knots. From this point of view Japanese silk is much inferior to

that produced by other countries, not only France and Italy but also China.

There are many causes that combine to produce knots and down on Japanese silk, but the chief one is the damp air in that country. Thus when winding or drying and preserving the cocoons in Japan it is highly necessary to maintain a very even temperature, still more than in continental countries such as France, Italy and China, where the atmosphere is generally dry. As this has been done the defects have been found to have largely diminished.

The author (engineer at the Yokohama Silk Conditioning House) gives figures showing the variations in the numbers of knots between 1900 to 1916 inclusively. On an average, in 1900, out of 500 metres of thread there were 3 knots and 265 downy spots, while in 1916 there were only 0.9 and 146 respectively.

The number of large and small knots tends gradually to diminish, which shows a great progress in the art of spinning. The number of defects began to decrease especially after 1912.

The author thinks that this good result may be due mostly to the propagation of first generation hybrids, which is so marked of late years that it constitutes a veritable revolution in the Japanese silk industry.

So as to test this hypothesis the author divided the silk-producing regions into 2 classes, one including the regions where first generation hybrids are in favour, the other including those where cocoons produced from native eggs are still numerous, and he has compared the silk produced by the 2 classes as regards its cleanliness. There was a decrease of 41.9 % of knots in the regions where hybrids are more widely diffused than native eggs and a decrease of 32.8 % in those regions where there is still a fairly high proportion of native eggs.

1393 — **On the Possibility of Rearing the Manatee as a Food Animal in French West Africa** (1). — MENEAUX, A., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 24, pp. 698-705. Paris, July 3, 1918.

Attention is first called to the experiments made by Dr. BELL in 1916 and 1917 in Florida on rearing the American manatee (*Manatus latirostris*) in half-stabling in the lagoons, experiments showing that this animal might be very valuable as a butcher's animal.

The African species, or Senegal manatee (*M. senegalensis*), inhabits all the estuaries and lagoons from the mouth of the Senegal up to the river Cuzeu, in Angola and often going considerable distances up the rivers. It thus occurs on all the coasts of Gambia, Liberia, Ivory Coast, Cameroons, Gabon in the Ogoové, Congo and even in lake Tchad. Morphologically it is little different from the American manatee, while the habits and structure

(1) See *R.*, Dec., 1917, No. 1206. In that article read "manatee" instead of walrus. The walruses or *Trichechidae* are arctic and circum-polar Pluropedia. They are carnivorous. The manatee, however, belongs to the Sirenia (e. g. *Manatus latirostris* of America and *M. senegalensis* of Africa); they live in the fresh waters along the Atlantic coasts of America and Africa; they are herbivorous. See *Cambridge Natural History*, Vol. X, Mammalia. (Ed.)

are identical; however, no specimens have been reported so large as those in America. Its food plants are not sufficiently precisely known, but as *Cymodocea nodosa* occurs in all the lagoons and estuaries where it dwells, there is reason to suppose, by analogy with what happens in America, that it browses exclusively on that plant. In captivity it eats vegetables such as lettuce, cabbage, celery tops, baked apples, spinach, and even bread.

The African manatee measures from 10 to 20 feet and its weight varies from 660 to 1650 lb. for old males. These animals are monogamous; the period of gestation lasts 8 months and the young are born in shallow lagoons where the mother can breathe without being forced to come to the surface. The family consists of 4 individuals: the adult pair, one half-grown and a calf, generally born in the autumn.

The meat of the manatee, like that of the dugong, and to the contrary of many new meats, has been liked by all those who have tried it; it has been compared to veal cutlets, to pork or tender beef; it is white, delicate and of a delicious taste; it is the meat of an herbivorous animal. When it is salted it is like excellent bacon with good keeping properties.

The tail, especially that of young animals, is a great delicacy when pickled and eaten cold; the sucking animal gives very delicate meat. The whole body is surrounded with a 1 1/2 in. layer of blubber, which gives an oil said to be equal to that of cod liver oil, having, moreover, the advantage of being odourless, tasteless, clear, and limpid as well as of not going rancid; it, however, contains no iodine. The bones are very compact and could replace ivory. Some 85% of the body of the manatee can be used as food; a manatee yields almost as much eatable meat as a steer.

The African manatee can be reared practically and it is to be hoped that the Governments of the African colonies will study the subject. In the first place it would have to be found out whether *Cymodocea nodosa* exclusively forms the food of these animals; if it contains iron, like the American species; where it best lives and if such are places where the manatee would live by preference. It would then be quite easy to fix on lagoons where stabling would be possible without too great cost, whether for starting or up-keep.

FARM ENGINEERING.

1394.—The Function of Agricultural Engineers as regards the Makers of Power-Farming Machinery.—COTÉ, Lieutenant, in *Providence*, No. 3, pp. 158-160+1 Fig. Paris, July 5, 1918.

Considerations of a purely agricultural order are of capital importance to makers and it appears from a perusal of technical treatises on power farming that mechanical engineers have not had such detailed information as would allow them to take such considerations into account in their researches. It is indispensable that the makers should be supplied as early as possible with all the desired information so as to avoid feeling their way of following a line that would only lead to disappointments to farmers. Many essential points have yet to be cleared up in this order of ideas.

The supporters of power farming are divided into two groups, and it is at present impossible to say which will vanquish the other. For the one, the problem of power farming consists in the simple substitution of mechanical for animal traction in various ways, while preserving the principle of the plough stock as well as the present instruments of cultivation. For the other, on the contrary, the question is that of replacing the work of the plough share by that of tools, the nature of which does not seem very clear any more than that of the movements by which these tools should be worked.

For the first group, supporters of the plough, it is absolutely necessary to turn the earth to a certain depth before winter. The second group insist that the earth should not be turned, but pulverised to a great depth. This theory, containing the principle of "dry farming" seems to be most applicable to very dry soils and new soils.

Makers can, therefore, justly ask the agricultural experts to say which of the 2 methods, ploughshare, or special parts driven mechanically either with a rotary or alternately rectilinear movement is the best. So far it seems that both methods are of interest. If the experts cannot decide that one method is certainly better than the other, it ought at any rate to be possible for them to state in what regions and under what climates one or other of the methods is the more suitable from the purely agricultural standpoint. They could then easily deduce over what areas one or other of the methods should be employed; the makers would then be able to decide the importance of the outlets opening for them in the two cases, and run their works accordingly. The engineers have yet to provide them with more precise detail as regards indirect traction by cable and windlass as well as regards direct traction by a motor-tractor, the compression of the soil, and the working speed of the plough. In the case when the ploughshare is to be replaced by working members, driven through suitable mechanism by an engine serving at the same time to propell the machine, the problem appears still more difficult. The author thinks that machines of this kind would only succeed in so far as the work they do (crumbling the soil) corresponds to the requirements of the land. If agreement is obtained on this principle, it remains to be settled how such crumbling should be carried out and to what degree of fineness and if the machine may not be required to have a digging action, all indications that can only be supplied by the farmer. According to the author light tractors of the Caterpillar type, in particular, seem indicated as immediately furnishing the best provisory remedy for the agricultural crisis. Tractors of the Caterpillar type have been used in large numbers for military purposes and have shown their worth. However, these machines could not provide final solution of the problem of power farming, as such a solution could only be reached through long researches.

1595 - **A Tractor School in Illinois, U.S.A.** — *Farm Implement News*, Vol. XXXIX, No. 31.
p. 18. Chicago, August 1, 1918.

The Farm Mechanics Division of the University of Illinois announces a series of short courses in tractors to be held between October 15, 1918 and

March 17, 1919. The schools will be held for 2-week periods, the number of pupils being limited to about 50. It is hoped to recruit the pupils from tractor owners, implement dealers and automobile dealers. The tuition will cost 2 \$ a week. The school will be under the direction of Prof. E. A. WHITE, instructor in farm mechanics.

1396 - Restrictions on the Manufacture of Farm Implements in the U. S. A. — *Farm Implement News*, Vol. XXXIX, No. 29, pp. 48-49; No. 30, pp. 12-13. Chicago, July 18 and 25, 1918.

The Conservation Division of the War Industries Board of the United States has published a schedule of farm implements and their parts which are to be eliminated so as to economise in labour and material.

The eliminations thus made apply: — 1) to grain drills and other seed-ing machines, fertiliser drills (only one size of broadcast fertiliser distributor can be made); none of these machines may be manufactured after Nov. 1, 1918; 2) partially to portable grain elevators, only one type being allowed; 3) to several types of ploughs, after Dec. 31, 1918, and especially to left-hand ploughs, which may not be made after July 1, 1918 (the sulky and gang ploughs are limited to a few types the most in demand); 4) to harrows, which are restricted to U-bar, channel bar and wood bar types; 5) to disc-harrows, save to 16-in. and 17-in. sizes, and those 4, 5, 6, 7, 8, 9 and 10 ft. long, the same applying to engine disc harrows. Tools used for raising sugar cane are not included in the list. The manufacturers are obliged to maintain and assure an adequate supply of repair parts of all types, sizes or types of implements becoming obsolete through these eliminations in order that farmers may be assured of necessary spare parts for a time in excess of the normal life of the various implements. Other eliminations are being planned for harvesters, mowers and rakes. From an inquiry made, it seems that one-horse mowers should be limited to the 3 1/2 ft. bar type and that hand dump hay rakes should be no longer made as well as all sizes of binders save those of 6-ft., 7-ft. and 8-ft cut. The construction of 2 row drills for maize and beans is limited to 2 types, one 28 in. to 3 ft. 8 in., and the other 32 in. to 4 ft.; these are the maximum and minimum adjustments, intermediate ones being optional with each maker. Detailed regulations for the manufacture of maize drills, and cultivators of various types are also given.

1397 - National Power Farming Show at Salina, Kansas, U. S. A. — *Farm Implement News*, Vol. XXXIX, No. 32, pp. 30-48 + 72 Figs. Chicago, August 8, 1918.

The national power farming show was held from July 29 to August 2, 1918, at Salina, Kansas, U. S. A., 48 makers with 232 tractors taking part. The ploughing depth was only 4 inches. Half of the ploughs pulled were 3-bottom ploughs, the remainder having 2 and 4-bottoms. Disc ploughs were shown; it appears that the use of disc ploughs has much increased in Kansas of late.

This demonstration was the first of a national character where official prony brake tests were made. The tests began 4 days before the show was opened; the results will not be published, but each maker receives a report

covering the tests of his tractor or tractors, and which he can use as he thinks fit, except that he can not publicly make a comparison between his own figures and those relating to other machines. The Belgian, French, Italian and Peruvian governments sent official representatives to attend the show.

Technical reports will be published later showing the value of the show.

1398 - **Tests of the Cleveland Tractor at Montpellier, France.** — CLARON, C., in *Le Progrès Agricole et Viticole*, Year XXXV, No. 23, pp. 150-153 + 1 Fig. Montpellier, August 18, 1918.

As the Cleveland tractor (1) had arrived too late to take part in the tests of vine cultivation by power at Montpellier, France, in 1918, it was tested separately at the School of Agriculture of that town.

During the tests in April, 1918, at Noisy-le-Grand, the tractor, on account of its small dimensions and the fact that it can turn in its own length was considered to be suitable for work amongst the vines. In tests among vines at Roche-de-Bran, near Poitiers (2), this tractor gave good results in rows 6 ft. 6 in. apart.

In this chain-track, 12-20 HP. tractor, the two driving wheels have been replaced by two pinions, which form the rear part of the machine and carry two chain tracks running over pulleys in front. Each track is 18 in. long and 7 in. wide and carries 44 teeth which act as spuds though not cutting. Owing to the gripping surface of each chain track (35.7 sq. decimetres) the tractor can work in any kind of soil. If the tracks wear on the macadam when used on the road, they have the advantage of not requiring, as do other tractors, a set of spuds or stakes to be put on to provide grip. The author says that, of all the tractors he has tried, the Cleveland is one of the easiest-starting ones. It is easy to drive and can turn in a circle of 143 in. diameter.

The tractor was tested on July 17, 1918, when it towed a 3-furrow EMERSON plough in a field that had been harvested a few days previously with a $\frac{1}{12}$ CASE tractor towing a "La France" binder. The soil was in good condition, but dry and the plough worked shallowly from 4 to 7 in.

RESULTS OF THE TRIALS. — No dynamometric tests were made, but by comparison the author was able to estimate that the 3-furrow plough required a tractive effort of 550 kg.; when lifted it required about 70 kg.; the traction per sq. decimetre thus works out at about 37.6 kg. The absence of a coupling between tractor and plough was regrettable as it would have saved numerous shocks to the machine. When ploughing the machine ran at about 2.3 miles per hour; in the long run the motor might suffer from such violent work.

The running tests gave the following results:— revolutions per minute, 720 slow and 1,550 loaded; average depth of ploughing, 5 in.; average width, 38 in.; furrow length, 417 ft. going and 394 ft. returning; total journey, 1,621 ft.; total area ploughed, 5,167 sq. ft.; time required for ploughing, 5 minutes 7 seconds; time required per acre, 89 minutes; petrol consumed

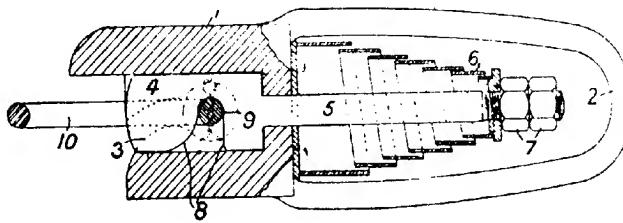
(1) See *R.*, October, 1918, No. 1145. (*F.d.*) — (2) See *R.*, Nov. 1918, No. 1267.

during trial, 0.239 gallons ; petrol consumed per acre, 1.9 gallons ; petrol consumed per 1000 sq. ft. ploughed, 1.03 gallons ; soil turned per lb. of petrol, 1 263 cu. ft.

On order to calculate the time required to plough an acre, the totals of the various stoppages during ploughing have been calculated, according to the practice at the Montpellier School, at $\frac{1}{4}$ hour of the total time necessary for the work. The results are excellent, according to the author, and allow the Cleveland to be classed among the best machines as regards its yield. Long duration tests will be carried out with this tractor near Montpellier. As the new type of chain tracks used in the Cleveland is so ingenious it is possible that they might decrease the wear for which chain tracks are blamed. The author considers that the Cleveland constitutes a distinct progress and should be considered amongst the chief tractors on sale in France at the present day.

1399 - **Couplings for Tractors.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXX, No. 4, pp. 112-114+3 Figs. Paris, July-August, 1918.

The author's researches on couplings have shown that a saving in traction for the engines can be made of 33 to 54 % on the starting effort and 10 to 30 % on the average tractive effort. If the use of couplings reduces the fatigue of animate engines it acts similarly on inanimate engines, for



SHANKLAND coupling.

which its use is shown by a saving in fuel estimated by the author at from 2 to 3s. per acre.

The author describes: 1) the coupling made by the "Ateliers BRILLÉ", 28, boulevard de Villers, Levallois-Perret (Seine), France. This spring buffer blocks at a pressure of 2 200 to 2 640 lb.

2) The buffer proposed by M. D. SHANKLAND, Great Clyde St., Glasgow (1). With this coupling the tractor can be separated from the plough at the end of the journey. The pieces 1 of the figure reproduced, forming part of the shackle 2, carries a slotted member in which fits the part united to the bolt 5 holding the spring 6 which is adjusted with the screw and lock-nut 7; the spring 6 is centered by means of the nuts 7.

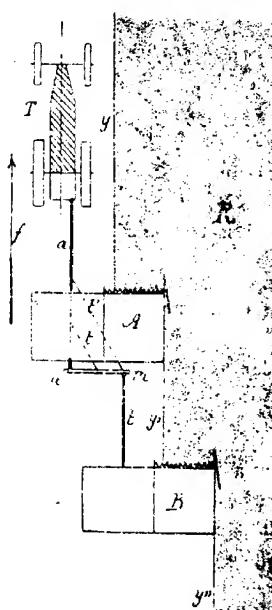
The attachment to the opposite side of the shackle 2 is by means of the hook 10 and the iron-pin 9 held in place by 2 keys. As the spring is com-

(1) See R., May, 1918, No. 566, Patent 112579 of the United Kingdom.

pressed by the pull, the pin 9, pulling the bolt 5, leaves the shoulder *a*, guided by two slits cut in the cheeks of part 1; the slits, at first straight, end in a curve shown by the dotted line 3. At the end of the journey of part 4, a little before the spring 6 is completely blocked, the pin 9 falls from the slits 3 and the hook 10 becomes free from part 4 and shackle 2; the tractor is then automatically detached from the plough thus avoiding breaking parts. The author has already remarked (1) on the similar automatically-unhooking coupling on the HOUROUX system. All the devices for automatic unhooking are advisable provided they are neither too heavy, nor too complicated to make and consequently too highly priced or out of proportion to the desired aim.

1400 - **Harvesting with a Tractor.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXX, No. 4, pp. 97-101 + 5 Figs. Paris, July-August, 1918.

M. F. BOUCHARD, director of the Dieufuit estate at Bellon-en-Houlme



Plan of tractor attached to two binders.

(1) See *Culture mécanique* by M. RINGELMANN, Vol. I, p. 16. Librairie Agricole de la Maison Rustique, Paris, 1913. (Author)

(Horne), France, has adopted a device shown on the appended figure for hitching 2 binders to a 16 HP. MOGUL tractor (1).

The shaft *a* of the first binder *A*, working on the width *yy'* is attached to the right of the tractor *T* running along the side *y* of the field.

At the rear of *A* is a cross-bar *mm* whose end *m* is held in permanent position by 2 braces *t* and *t'* which prevent the angle *anm* from opening; the tie-rod *t'* passes under the platform of the binder *A*. Near *m*, at the desired point, the shaft *b* is attached of the second binder *B*, which can thus turn round the point *m* and the whole machine moves in the direction shown by the arrow on the side *R* to be harvested, cutting over the width included between the parallels *y* and *y''*.

The mounting used for 2 MacCormick binders, cutting 59 in. to the right hand, enables them to turn in the smallest turning radius of the tractor. M. BOUCHARD turns outside to the right without cutting; the tractor begins to turn when the second binder is at the corner of the field to be cut. Before the machines enter, the field is cleared on a width of 22 to 26 ft. The author thinks that less width could be freed if the first turns were done with a single binder, even by only cutting the 2 long sides of the field; the second binder would be attached after sufficient space has been cleared.

With a 59 in. cut, on a width of 95 in., M. BOUCHARD cut as much as 7,176 to 7,296 sq. yd. per hour; a driver is required for each binder. The author recalls the MASSEY-HARRIS device for attaching a binder to a tractor. Instead of the ordinary pole used with a team, a frame in the shape of an isosceles triangle is fixed in front of the binder, the summit of the triangle pointing towards the carrying and driving side of the binder; the forward base of the isosceles triangle carries a horizontal screw working in a nut fixed to the shaft through which the machine is hauled. The screw is moved by a bevel gear and a pointed shaft ending in a wheel by the driver. The frame is prolonged under the binder frame by a bar to the back end of which the pole of the next binder is attached.

1401 - Simultaneous Harvesting and Breaking-up of the Stubble with a Tractor. - *Le Génie Rural*, Year X (New Serie., No. 24), No. 84, pp. 7-8 + 2 Pigs. Paris, 1918.

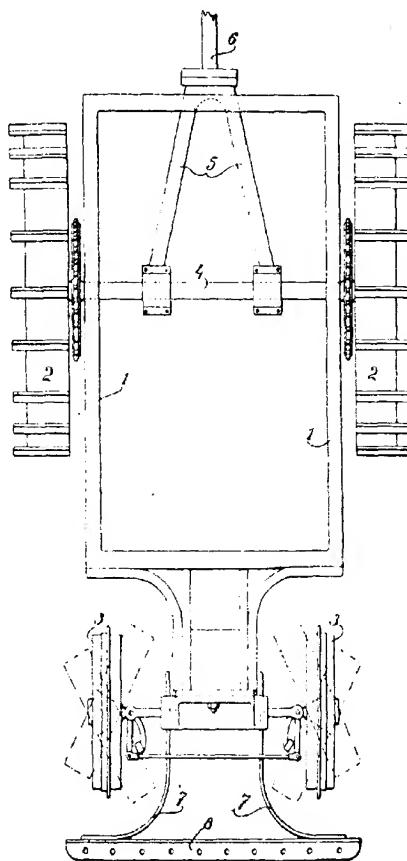
To hitch a 13-time MASSEY-HARRIS cultivator to a binder towed by an AVERY tractor (2), M. GRATEAUT, of Epernon (Eure-et-Loire), France, uses an iron bar 6 ft. 6 in long bolted on to the shaft of the binder and clamped behind on the binder frame. On the steering device of the cultivator are bolted 2 flat irons joined by a bolt to the end of the bar projecting from behind the binder. This device is to leave steering free in a vertical direction but to render it rigid horizontally, so as to allow the binder and cultivator to back if required.

M. L. DANCAUD, of Levet (Cher), has designed a device similar to that just described and which is also intended to carry out 2 operations at once. Although less simple than the former, as it requires a special tractor, M. DANCAUD's device is said to constitute a great progress in mechanics.

(1) See *R.* February, 1918, No. 291. (*Ed.*)

(2) See *R.*, 1917, No. 945 (*Ed.*)

traction. Instead of towing the binder by a tractor and hitching a stubble breaker behind the binder the new arrangement makes it possible to attach the binder in front of the tractor and the stubble breaker behind. Thus



Plan of DANCHAUD tractor.

the tractor pushes one machine and pulls the other. One man can drive the tractor and supervise the working of the 2 machines. Moreover, as the binder is in front of the tractor, it can cut a greater width as there is no

risk that the tractor will pass over the uncut crop. Other machines that work suitably together can be used to replace the binder and stubble breaker (hay mower and hay maker, or one binder in front and another behind the tractor).

In addition the device is well suited to the direct driving of the working parts of agricultural machines in general and specially of binders and reapers by the tractor engine. The appended design gives a plan of the invention. The apparatus includes a frame on which is mounted the engine with the gear, drive and controls. The frame is mounted on two driving wheels 2 in front and 2 steering wheels 3 in the rear. In front of the frame two arms 5 are mounted on the axle 4 and carry a shaft 6 for connecting with the machine to be driven or partially or totally supported.

In the rear of the frame, the arched pieces 7 of the steering gear are mounted. These pieces have their end joined to a draw bar 8 for such agricultural machines as have to be drawn by the tractor.

1402 - Log Saw. - MANRIN, G., in the *Journal d'Agriculture pratique*, Year LXXXII, New Series, Vol. XXXI, No. 18, p. 353 + 2 Figs. Paris, September 5, 1918.

Log saws made by M. BIAUDET FORTIN, of Montereau (Seine-et-Marne) France. In the "Rustic" type of log saw the circular saw is mounted on ball bearings; the saw is 24 in. in diameter and is protected by a cov. The log to be cut is placed in a rectangular cradle whose frame is mounted on a horizontal axle placed lower down. Once the log is placed in position all the man has to do is to push it towards the saw, pressing more or less according to the hardness of the wood so as not to stop the machine to make the driving belt slip.

To provide the military type of log, the War Administration uses similar saws driven by a petrol motor, the whole being carried on a truck mounted on 4 cast-iron rollers. The motor and its accessories are at once of the truck, behind the water tank mounted on the tool box; the fuel tank strengthened by oblique stays hooked to its upper edge and fastened below to the truck. The saw, whose frame is made of steel angle-irons, is bolted to the other end of the truck above the front wheels.

1403 - An Improvised Pasteurising Plant. - BALLHAUSEN, O. C., in the *Agricultural Gazette of New South Wales*, Vol. XXIX, Pt. 2, pp. 128-130 + 1 Fig. Sydney, February 2, 1918.

An ordinary rapid pipe-cooler with 16 2-in. pipes, and 42-in. high x 54-in. long, has been transformed into a pasteurising plant by Mr. MC DERMOTT, the Manager of the Bonalbo Dairy Company. The brine is replaced by hot water and live steam which are pumped through the pipes. To prevent the cream splashing on falling onto the heat pipes, two tinned sheets, 24-in. high and 54-in. long, were fitted close against the pipes. The top edges of the sheets are bent outwards while the lower edges are bent inwards. A depth of 18-in. at the bottom of the heater is not covered by the sheets, the idea being to allow the gases and steam arising from the heated cream to escape.

The cream passes off the heater into the tanks at from 160 to 170° F.

150 gallons an hour can be heated to 160° F. Cooling is carried out in the same machine, being continued till the cream is at 48° F. The day after the cream is churned at the same temperature.

Mr. L. T. MAC INNES, the Acting Dairy Expert, found the butter made from cream thus treated to be of choicest grade and to have no cooked flavour at all.

1404 - Equipment for the Commercial Evaporation and Drying of Fruit in the U. S.

A. — BEATTIE, J. F. and GOULD, H. P., in the U. S. Dept. of Agriculture, *Farmers' Bulletin* No. 933, 60 pp. + 22 Figs + Bibliography of 20 Publications. Washington, September, 1918.

Although intended for those who contemplate engaging in the art of drying or evaporating fruits or vegetables, this bulletin contains very useful information for all who wish to dry fruit for home use. The authors describe the various types of equipment for drying fruits or vegetables, as well as the methods of heating that are most used and which have given the best results taking their simplicity and economy into account.

The driers used in the apple-drying industry of the eastern portion of the United States are for the most part of the kiln type. The almost universal use of this type is due to the low first cost of the kilns and the small amount of labour required to operate them. In an area of western New York there are some 2,000 commercial driers, 500 being large plants; about 75 % of the evaporated apples produced in the eastern portion of the United States come from this area. Other States, such as Virginia, Illinois, Arkansas and Missouri, also produce considerable quantities of evaporated apples, most of which are prepared in kiln driers.

The modern kiln consists of a structure two stories high, the ground floor being occupied by the furnace while the second floor serves as the drying room. The construction of the building, the air ducts, the drying floor, the drying plant, are all described in detail, plans and figures being also given.

The steam-heated cabinet drier has been found to be a more efficient type as well as being adapted for use in any locality. There are 6 rows of steam pipes spaced so as to admit two trays between every two rows of pipes. The description of this drier is accompanied by figures showing the construction and working details.

Tunnel driers require more labour, and for this as well as other reasons they have never come into general use in the apple-drying districts of the eastern portion of the United States. They are suited for drying cherries, maize or other material best handled by spreading on trays.

The bulletin describes the preparation of fruit for evaporation, the evaporation of the fruit, the time required for drying, etc., and gives practical directions for drying peaches, pears, cherries, prunes, etc. The sun drying of fruits, the preparation of evaporated and dried fruits for market, are dealt with and the laws relating to evaporated and dried fruits in force in the United States are considered.

1405 - The Installation and Equipment of an Egg-Breaking Plant. — See No. 1421 of this *Review*.

1406 - Review of Patents.

TILLAGE MACHINE AND IMPLEMENTS. — *Italy*: 159733 Universal plough with self regulator; 161069. *VITALE* motor balance-plough.

New Zealand: 39696-39825 Raising, lowering and depth regulating device for ploughs.

Switzerland: 79134 Soil tillage apparatus.

United States: 1273801-1274586-1274866 Harrows; 1273829 Attachment for ploughs; 1274075 Draft wheel connection for wheel and gang ploughs; 1274876 Stalk chopping machine; 1275209 Plough; 1275588-1276017 Cultivators; 1276051 Vineyard plough; 1276334 Combination plough and pulveriser; 1276645 Harrow tooth.

DRAINAGE AND IRRIGATION. — *Canada*: 184106 Excavator.

Italy: 160124 Self acting water lifter for drainage, irrigation, etc.

Sweden: 43482 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Italy*: 161557 Physiologically complete mineral manure of natural plant salts for directly fertilising all agricultural seeds and plants

Sweden: 43481 Manure spreader device.

United Kingdom: 117958 Combined manure and seed distributor; 118225 Machine for sowing seeds.

United States: 1274343 Fertilising method and material; 1275332 Fertiliser distributing mechanism; 1275683 Manure distributor; 1275736 Fertiliser chemical and composite distributor; 1276047 Feed regulator for fertiliser sowers.

DRILLS AND SEEDING MACHINES. — *Canada*: 184285 Land marker; 184533 Potato sowing machine.

Sweden: 43480 Potato planting machine.

United Kingdom: 117938 Potato planter; 117958 Combined manure and seed distributor; 118225 Machine for sowing seeds.

United States: 1274062 Three row maize planter; 1274239 Maize planter; 1274447-1274885 Planters; 1276588 Peanut planter; 1276646 Potato planter.

VARIOUS CULTURAL OPERATIONS. — *Italy*: 153315 PAVONE hoe; 160735 Tree straightener.

Sweden: 43483 Combined weeder and rake.

United States: 1274527 Mulch for sugar cane and the like; 1274718 Cotton chopper; 1275356 Maize cultivator.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Switzerland*: 79136 Motor sprayer; 79285 Rat trap.

United States: 1274201 Weed puller.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada*: 184076 Flax harvester; 184532 Stooking mechanism; 184723 Grain binder mechanism.

Sweden: 43450 Mower device.

Switzerland: 79135 Basket attachment for mower.

United Kingdom: 118255 Fork for swath turning or potato digging machine.

United States : 1273814 Cotton harvester; 1274432-1275551 Maize picking and husking machines; 1275062 Cutter bar mechanism; 1275599 Mowing machine; 1275689 Platform latch for reapers; 1276064 Transporting vehicle for grain shocks; 1276295 Non clogging maize harvester knife; 1276324 Maize cutter.

MACHINES FOR LIFTING ROOT CROPS. — *Sweden* : 43652-43683 Potato diggers.

United Kingdom : 117950 Machine for gathering, topping and cleaning root crops which have been dug either by hand or machine and laid in rows on the ground; 118255 Fork for swath turning or potato digging machines.

United States : 1276441 Potato digger.

THRESHING AND WINNOWING MACHINES. — *Canada* : 184085 Potato separator.

Netherlands : 2554 Grain cleaning machine.

Sweden : 43391 Device for self cleaning thresher; 43580 Threshing machine.

United States : 1274085 Potato sorter; 1274881 Pea huller.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN FODDER, ETC. — *Canada* : 184070 Grain pickling device; 184272 Bag holder.

Sweden : 43536-43685 Rack for drying grain and forage.

United States : 1273975 Hay cutter; 1274186 Grain treating machine; 1274541 Hay carrier; 1274682 Baling press; 1274849 Drier for seed maize; 1275722 Hay loader; 1276044 Cotton seed drier; 1276190 Ensilage spreader and packer; 1276205-1276295 Maize stalk rake; 1276355 Cotton seed litter.

FORESTRY. — *Canada* : 184810 Tree sawing machine; 184837 Rotary wood cutting machine.

United Kingdom : 117882 Cross cut saw for felling standing trees.

United States : 1276140 Stump burner.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *Canada* : 184163 Wagon tongue mechanism; 184537 Traction belt.

Sweden : 43393 Driving wheel for motor plough and tractor.

Switzerland : 79133 Tractor for agricultural machine.

United States : 1274089 Draft equaliser; 1274473 Mechanical tractor for agricultural purposes; 1274574-1274968-1276035 Tractor attachments; 1274588 Hydraulic motor; 1275071 Extension steering device for tractors; 1275343 Tractor frame; 1275344 Track laying tractor; 1275600 Tractor; 1275761 Tractor hitch; 1276515 Tractor wheel.

FEEDING AND HOUSING LIVESTOCK. — *Canada* : 184203 Animal releasing device; 184499 Hog feeding machine.

Italy : 159905 Simultaneous releasing device for stables.

United States : 1274483 Horse shoe; 1275144 Combination hog trough; 1276449 Cattle stanchion.

POULTRY FARMING. — *United Kingdom* : 117890 Hand appliance for cutting up food for poultry.

United States : 1274104 Device to prevent hens from setting; 1274166 Incubator; 1276543 Incubator regulator.

FISHING. — *Canada* : 184451 Gill net sinker; 184981 Fishing hook.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada* : 184191 Grain milling machine

Italy : 155198 New system of extracting sugar from sugar beet and other plants; 159323 Apparatus for the rational germination of grains and cereals; 159501 Citrus essence extractor with articulated combs working under water; 159733 New wine-making process; 159817 CARA oil and fermentation residue press; 159915 Scutching machine; 160033 Machine for the preparation, trituration, subdivision, multiple division and working of germinated wheat, or other cereal, vitalised, fermented or treated in any other way so as to soften it; 160115 Worker for germinated cereals.

Switzerland : 79173 Bolting machine.

United States : 1273974 1274803 Nut cracking machines; 1274704 Bread making machine.

DAIRYING. — *Canada* : 184277 Milk pail.

New Zealand : 39946 Milking machine pulsator; 40103 Milking machine teat cup.

Sweden : 43317 Centrifugal separator driven by a petrol motor fixed underneath; 43392 Separator drive mechanism; 43427 Rotary churn with removable inside wing; 43452 Device for vacuum milking machine; 43577 Bowl device for rotary churn; 43610 Device for heating milk before being fed into a separator driven by petrol motor.

Switzerland : 79332 Churn.

United States : 1273916 Cream separator; 1274393 Combined churn and butter worker; 1274748 Process of treating milk by heating to about 140°F. and cooling to about 40°F without removing from the same vessel; 1274759 Process of treating milk and the like by sterilisation; 1276184 Milking machine.

FARM BUILDINGS. — *Canada* : 184203 Animal releasing device.

Italy : 159905 Simultaneous releasing device for stables.

United States : 1274727 Horse shoeing stand; 1275148 Silo; 1276449 Cattle stanchion.

VARIOUS. — *Canada* : 184169-184701-184772 Pumps.

Italy : 160978 Improvements to rotary pump.

United States : 1273913 Centrifugal pump.

AGRICULTURAL INDUSTRIES.

1407 - **On De-foxing Wines.** — RAVAZ, L., in *Le Progrès agricole et viticole*, "Est-Centre" edition, Year XXXIX, No. 37, pp. 244-246. Villefranche, Rhône, September 15, 1918.

The author, looking back on the methods for de-foxing proposed in his journal (1), suggests that, in all these processes, oxidation probably plays the most important part. If this is so, on treating foxy or musty

(1) See *R.*, May, 1916, No. 555, Feb., 1917, No. 183 and June, 1918, No. 684. (Ed.)

musts or wines by an oxidising agent, the undesirable taste ought to be removed. Experiments made by the author have shown this to be the case.

There are many oxidising agents. The best results have been obtained with manganous acetate and potassium permanganate; but their use is not allowed in wine-making. Hydrogen peroxide, which adds nothing to the vintage that is not already present and leaves no trace behind, is still more active. At the strength of 10-11 volumes, used at the rate of 1 litre per hectolitre, in less than one hour all trace of a foxy or musky taste has been removed from the wine or must. The same result is obtained whether must or made wine be treated. If the dose is stronger, the action is also more rapid, but the oxidation is carried still further and wines are obtained that are aged by several months or even years.

In the grapes, musts and wines, there are natural oxidising agents. In particular there is a diastase which the author was the first to report in wine and which, especially in Grenache, greatly helps to turn an almost yellow shade and causes the bouquet to disappear. If sulphurous acid is used in winemaking, it should only be used after defoxtion in order to limit the action of the diastase.

The same oxidase is produced in the grape by the fungus *Botrytis cinerea*, which causes grey mould.

Some day this oxidase may be obtainable commercially.

By making wine according to these directions a more or less marked "casse" will be produced in the wine, but its effects can always be controlled.

1408—On a Water Bacterium Living in Bitter Wines that can Dehydrate Glycerine; Glycerine-Reaction. — VOISINER, E., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 10, pp. 476-510. Paris, October, 1918.

The author has found the presence in water (1) of a ferment having properties similar to those of a bacterium living in bitter wines, which he had previously isolated and studied (2). Each of these organisms can dehydrate glycerine, changing it to acroleine. The author has studied these two bacteria, and has extended the work to cover other bacteria that may be found in water, such as *B. coli*, *B. typhus* and *B. para-typhus*.

The general morphological, biological, cultural and biochemical characters of the bacterium isolated from water, on comparison with those of the bacterium from bitter wine, show a close resemblance between the two organisms. Each organism, on inoculation into a suitable vinous medium, can produce the "bitter disease" of wine with all its organoleptic, microscopic and chemical properties, especially by forming, at the expense of the glycerine, acrylic aldehyde, a substance found by the author to be formed in all wines whether new or old, affected with true bitter disease.

Both organisms seem to belong to one and the same species which, from its habitat, its physiological function regarding glycerine and its pathological function in wine, the author has named *Bacillus amacrylus*. As the

(1) *Annales de l'Institut Pasteur*, Vol. XXVIII, p. 507, 1914. (Author.)

(2) See *R.*, July, 1913, No. 871. (Ed.)

water bacterium constitutes the type species, that of bitter wine can be considered as the same species, with its hereditary qualities simply modified by the necessary adaption to its new food environment, or at any rate as a variety.

This work shows how the introduction of water into wine, which cannot be avoided in practice, whether during vinification or bottling, causes infection with the germ of the disease.

This water bacterium shows analogies and differences with *B. coli* and the typhus and paratyphus bacilli. Like them it grows in phenol broth at 1% at 42° C. From its character as a lactic ferment, by its action on media coloured with litmus or neutral red, or colourless like the rosaniline medium of ENDO, it resembles FISCHER'S bacillus and differs from that of EBERTH and even the paratyphic one. The absence of indol-production would produce an inverse result in comparison, if it were not known that the types of colitacilli, of the variety *anindolicus*, can form that substance.

Two fundamental properties, the one biological, the other chemical, differentiate this organism from those compared with it by the author and which are, at any rate one of them, of too common occurrence in water:—it is not pathogenic and it causes the acrylic fermentation of glycerine.

Using the property possessed by *B. amacrylus* of fermentating glycerine with the production of acroleine as a basis, the author describes a special reaction which he calls the "glycerol-reaction", which enables this bacterium to be distinguished from the other above mentioned bacteria in water analysis. [5]

1429 — **Sudan Dura as a Brewing Material.** — BRIANT, L. and HARMAN, H., in the *Journal of the Institute of Brewing*, Vol. XXIV (Vol. XV, New Series), No. 5, pp. 207-214. London, June, 1918.

— In 1916 the Imperial Institute sent the authors samples of Sudan dura with a request for their opinion as to its use for brewing purposes. The first experiments led the authors to conclude that, in spite of its high percentage of fat, dura might prove of value in brewing, especially in view of the present shortage of grain. In May, 1917, having obtained 5 to 6 tons of dura, the authors investigated the possibility of using it as 1) malt, 2) roasted grain, 3) flaked grain, 4) glucose, with the following results: —

MALT. — The dura is not easy to handle during germination; the aerospore, having no protective skin as in barley, is exposed and easily injured and detached during the frequent movement of the grain. Analyses showed a good development of enzymic activity as represented by the diastatic power (24° LINTNER as opposed to 30° for barley malt), and the results are similar to those for barley malt, except in the case of the extract, which is very scarce.

ROASTED GRAIN. — Experiments were made with malted and unmalted grain. The products were satisfactory in aroma and flavour and compared favourably with the products obtained from barley. The roasted grain was tested by London brewers for the manufacture of porter. The porter brewed with dura was better in colour than that brewed with roasted barley although a smaller proportion was used. Experts judged the flavour of the

first in no way inferior to that of the second. It was found possible to substitute dura for barley in the proportion of 7 of dura to 10 of barley without changing the character of the beer.

Two tests in the making of amber malt showed the flavour to be excellent, but the extract yield was low as a result of difficulty in malting. Could this difficulty be overcome it should prove possible to obtain a satisfactory extract.

FLAKES. — The flaking process is easily carried out and the starch gelatinises without difficulty. The yield in dura flakes was approximately 80 %, as compared with about 68 % for maize and 95 % for rice. Sufficient flakes were obtained to make comparative brewing tests in which half the usual proportion of flaked maize (15%) was replaced by flaked dura. The results were satisfactory and brewing experts judged dura flakes to be equal to maize flakes. The author considers dura flakes perfectly suitable not only for brewing purposes, but also as a food for human consumption.

GLUCOSE. — Satisfactory preliminary results having been obtained, about 2 tons of dura were used for making glucose which was used in part for brewing. The sugar obtained was of the malto-dextrin type. The beers made were carefully examined. It was found that in new bitter beers decidedly better results were obtained with dura sugar than with invert sugar, but that in new mild ales dura sugar gave rather less fulness than invert sugar, but that in new mild ales dura sugar gave rather less fulness than invert sugar. The beers were again examined after 3 or 4 week's storage. The beers made with dura sugar were of better quality than those made with invert sugar.

The authors consider that if sufficient dura can be obtained at reasonable prices it may be used successfully as a substitute for roasted barley in the manufacture of flakes and sugar of the malto-dextrin type. Several tables of quantitative analyses are given.

1410 — **The Potato Starch Industry in Italy.** — GARELLI, F., in *Le Industrie Italiane Illustrate*, Year 1, No. 8, pp. 45-58. Milan, August, 1912.

The first potato starch factory was founded at Milan in 1885. This, facing great difficulties and owing to initial errors (foreign competition; insufficient protection of 2 lire per quintal; establishment in a large town distant from the large potato-producing centres; absence of sufficient experience in growing big yielding varieties) was obliged to spend work. In 1900-1901, three starch factories were founded at Ravenna, Bologna and Ferrara, after the agricultural, and most important, side of the question had been thoroughly studied to assure success. After two seasons, the Bologna (the largest) works and that at Ferrara had to close down. At the end of the last century, a small works was installed at Pinerolo, (province of Turin) as the result of propaganda carried out by Prof. A. GARELLI of Turin University in favour of growing the industrial potato. As the district was unsuited to the industrial crop, the competition due to other better known and more paying crops lead to its being abandoned.

It was owing to the success of the sugar-beet crop, that industrial potato growing was attempted in 1900-1901. Everything seemed favourable

able to the new industry, the cotton spinners alone imported 150 000 quintals of starch for finishing, of a value of 4 to 5 million *lire*; the sale price, including an import duty of 2 *lire*, varied between 30 and 32 *lires* the quintal. On the other hand the yield per hectare was 270 to 300 quintals for well prepared crops, thus assuring a satisfactory price of 3.5 to 4 *lire* per quintal.

The plant required for a starch factory is relatively simple; one-tenth of the capital required for a sugar factory suffices for a starch factory, which moreover, requires much less fuel.

A small works with 100 hectares of land available can work 200 to 300 quintals of potatoes per day for a season of 3 months, producing 50 to 60 quintals of starch per day or 5 000 to 6 000 quintals during the season. The Rovigo factory can deal with 500 quintals a day. From 15 to 20 starch factories, both large and small, and 3 000 hectares of land devoted to potato-growing would suffice for Italian needs. The Italian starch products are appreciated; and the reason for the failure of the industry to develop is especially foreign competition, the foreign product being sold at 23-24 *lires*, including the import duty. The starch factory could not reduce its prices without reducing the buying price of the potato. In 1911 there were 663 factories in Germany, including 441 agricultural starch factories.

According to the Bulletin of the Italian Ministry of Finance, the imports of European starch were: —

| Years | Quintals imported | Average | | Total value in lire quintals |
|-------|-------------------|--------------------------------------|---------------------|---------------------------------|
| | | price in <i>lires</i> per quintal | Total value in lire | |
| 1909. | 169 550 | 32 | 5 425 792 | |
| 1910. | 158 450 | 32 | 5 070 658 | |
| 1911. | 145 709 | 37 | 5 391 233 | |
| 1912. | 151 221 | 34 | 5 141 514 | |
| 1913. | 161 949 | 30 | 4 858 470 | |

In these figures arrow-root and sago flours are not included. The starch from tropical plants is listed in the tariff as exotic starch; in 1913 79 619 quintals of a value of 2 627 427 *lires* were imported. The total imports of starch thus represent a value of about 8 million *lires* annually.

At present only one starch factory — that at Rovigo — is working in Italy.

1411 — **War Syrups.** — DELLE, E., in *Le Moniteur Vinicole*, Year LXIII, No. 41, p. 162, Paris, October 8, 1918.

It is absolutely prohibited to add saccharine to syrups (to the contrary of liqueurs, to which saccharine can be added freely) in France. As sugar is very scarce and glucose being both very scarce and very dear, syrup makers are very embarrassed. All that remains is honey and naturally-sweet fruits (figs, dates, etc.) which are only available in small quantities and that

at high prices. The makers have the alternative of preparing liquids without sugar, but of syrupy consistency, which they could not sell under the name of syrups, but which could replace them if the consumer himself would add a little saccharine to his drink.

To obtain the required syrupy consistency recourse may be had to plants containing mucilaginous matters of agreeable taste, or at any rate insipid and improved by adding suitable perfumes. Anything that might produce undesirable clots must, of course, be rejected. Gum arabic is excellent for this purpose, especially if good material is used; in fact some qualities give solutions which are clarified with difficulty, and any muddy syrup cannot be sold unless by its nature it is really opalescent.

On account of this year's fine grape harvest in France, the preparation of grape syrup is advised. It would be dear on account of the high price of wine, but it is an excellent product which, though long abandoned, is well worth reviving. It is made by heating vintage must, then skimming; chalk is added to neutralise the acidity somewhat; the liquid is filtered, and boiled vigorously until it weighs 32° Baumé. The product is kept in well-corked bottles in the dark in a dry place.

1412 - **Commercial and Domestic Fruit Drying.** — See No. 1404 of this *Review*.

1413 - **Opium Wax.** — JITENDRA NATH RAKSHIT, in *The Analyst*, Vol. XLIII, No. 510, pp. 321-322. London, September, 1918.

Wax is best extracted from opium by means of cold petroleum ether at the rate of 800 cc. of petroleum ether to 200 gm. of dry powdered opium. The ether is decanted off and the extraction repeated for 3 more days with 700, 600 and 500 cc. petroleum ether successively. The extracts are united, shaken with hydrochloric acid and then with anhydrous sodium carbonate. The solution is filtered and evaporated, giving 14.35 gm. of a brown, sticky mass having an odour somewhat resembling cod-liver oil. This opium wax gave the following results: — Iodine value, 152.5; Reichert value, 2.0; saponification value, 114.5.

1414 - **Acetic Acid Manufacture on Rubber Estates.** — KEUCHENITS, P. E. (*Bisectisch Proefstation*), in *Archief voor de Rubbercultuur in Nederlandche-Indië*, Vol. 1, No. 5, p. 413-417 + 1 Fig. Batavia, 1917.

Owing to the continually increasing market prices of acetic acid, an attempt was made to produce acetic acid according to an old method and find out whether the acid obtained in this way would really be cheaper and whether rubber coagulated with this acid would be not inferior to rubber coagulated with imported acetic acid. Investigations by the Buitenzorg Central Rubber Station have proved that these questions are to be answered in the affirmative.

The method mentioned is very simple and is founded on the fermentation of alcohol to acetic acid. The whole installation required for this purpose consists of a wooden cask.

Taking into consideration the price paid now for alcohol, the acetic acid obtained through fermentation of alcohol will cost about rs. 10d, per lb. Should it be possible to use methylated spirit, then the acetic acid would

cost about 3d. per lb. This acid, however, is of a low percentage concentration which can be easily ascertained by titration.

1415 - **Mechanical Coagulation of Rubber.** — ZUYDERHOFF, G. J., in *De Indische Mecenauw*, Vol. LXI, No. 32, pp. 620-621. Amsterdam, 1918.

The author first reviews the best known methods for coagulating rubber, shows their respective advantages and disadvantages, and then describes the new method of coagulating by heat, together with the results it has given on testing it. The present high price of acetic acid and the hope of obtaining a product with better qualities lead the author to carry out the following experiments: —

The recipients usually used for coagulation are heated moderately from below while a current of ordinary or dry air is passed above. Another way consists in passing a current of warm air above the recipients containing the latex. To prevent the formation of a skin that would hinder the action of the air on the deeper layers of the latex, the author advises stirring the mass, or better still, keeping the recipients slightly agitated. The mass, when once well taken, is left and finally crêped. The colour of the crêpe thus obtained is quite light although in the first tests it varies greatly in each sample. The quality of the product seems quite comparable with that of samples obtained by chemical coagulation. The author insists on the economic side of the method, which, by this fact alone, is of interest and worth perfecting through further researches.

1416 - **The Utilisation of Coal Dust for Heating Greenhouses.** — RIVORRE, P., in the *Rue Horticole*, Year XC, No. 9, pp. 157-158. Paris, September 16, 1918.

In order to utilise coal dust, M. REVERCHON, horticulturist of Moulinvent, near Lyons, France, devised a method of consolidating it with lime as far as cannot be obtained at present. He made bricks, using an iron mould such as that used by masons for making flag-stones. The mould is composed of two flat, elbowed irons, joined at the edges by clamps. The mould is placed on a piece of sheet iron with two handles, which enables it to be carried. The bricks are made with 5 kg. of lime, 20 litres of water and 100 kg. of coal.

The lump quicklime (now sold at Lyons at 11s. 10d. per hectolitre weighing 158 to 165 lb.) must be slackened one or two days before use with a equal quantity of water. When making the bricks the lime is put in wooden tub together with the required amount of water and mixed vigorously with a trowel. The coal is placed on the ground near at hand. A hole is made in 100 lb. of the dust and the contents of the lime poured into it two or three times. The mixture is stirred with a shovel to mix it well and distribute the moisture equally. The mould is then filled with the mixture by means of a trowel and the contents pressed down. The slight hollow formed is filled up, the whole re-pressed, and levelled with a trowel. The bricks are taken from the mould by removing the clamps and dried in the shade for about a week. If they are dried too rapidly in the sun the mixture remains powdery and the bricks break up too easily. The bricks weigh 11 to 13 lb., so that 100 lb. of coal will make 9 bricks. With a little practice 22 bricks an hour may be made.

To test the use of the bricks a fire was lit in a greenhouse furnace. Although little wood was used the bricks took fire easily. They ignited gradually and gave out a great heat although they were made with very bad coal. It is difficult to understand the part played by the lime, though it seems to act as a cement.

In view of the shortage of fuel this method is very valuable. It would also be of great service to horticulturists by allowing them to use a diet of bad quality coal for heating their greenhouses.

1417 - **The Refractometric Estimation of Milk Sugar.** — PANCHAUD, L. and AUERBACH, E. (Cantonal Laboratory, Geneva), in *Travaux de Chimie alimentaire et d'Hygiène*, Vol. IX, Pt. 5, pp. 236-239 + 3 Tables. Berne, 1918.

Communication to the 30th General Meeting (1918) of the Swiss Society of Chemists and Analysts.

The refractometric estimation of the lactose in cow's milk, started by WOLNY (who used a calcium chloride serum and a special milk refractometer) has made little progress. But ACKERMANN, using his chlorocalcic serum and the ZEISS immersion refractometer, has shown that WOLNY's tables could, with some slight modifications, be adapted to the graduation of the immersion refractometer (*Mitteil. Lebensmitteluntersuchung und Hygiene*, Vol. VII, p. 319. Berne, 1916). GABAIHULER has drawn attention to the importance and value of lactose for valuing milk from a hygienic standpoint; in fact a clear decrease in the lactose is seen in sick animals, especially if they are suffering from diseases of the udder (*Zeitschrift für Fleisch und Milchhygiene*, 1915, Vol. XXV, p. 97). Since then the method has become very interesting. In order to ascertain the final difference between the lactose content estimated refractometrically and that obtained gravimetrically, the authors have tested a large number of milks of different origin and varying freshness (normal or watered fresh milks, sour milks, abnormal milks from sick cows) by means of the ACKERMANN method for the refractometric estimation and the ALLMÜller method for the gravimetric estimation. The results, given in table form, lead to the following conclusions: —

1) For fresh, normal or watered milks, there is a remarkable concordance between the refractometric and gravimetric results.

2) For sour milks, the refractometric method gives results that are too high (one part of lactose, changed into lactic acid of a high refractive power, and one part of albuminoids coming into solution, are no longer precipitated by the calcium chloride).

3) For abnormal milk from sick animals, the refractometer figure is too high, owing to the increase in the chlorides and changes in the albumins and casein due to the pathological condition.

1418 - **Free Lactic Acid in Sour Milk (1).** — VAN SLYKE, L. L. and BAKER, J. C. (Chemical Laboratory of the New York Agricultural Experiment Station, Geneva), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 147-178 + 12 Tables. Baltimore, July, 1918.

When speaking of the acid constituents of sour milk, the lactic acid is understood, as if the acidity were due directly and entirely to the presence

(1) See the summary of a previous paper by these writers, in *R. May*, 1918, No. 576. (Ed.)

of free lactic acid as such. When milk sours under ordinary conditions, lactic acid is first formed, but this reacts at once, practically as fast as formed, with the basic constituents present in the milk. In fresh cow's milk, the compounds reacting with acids are, first, basic phosphates and citrates of calcium, magnesium, sodium and potassium, and, second, calcium caseinate. When the lactic acid of sour milk reacts with these compounds numerous salts are formed, the essential results of the reactions being monocalcium phosphate, free casein and calcium lactate. In view of this there will not be much free lactic acid in souring milk until these reactions are practically completed.

The authors have used three methods for determining the amount of lactic acid in sour milk : — 1) measurement of hydrogen ion concentration and application of the mass law ; 2) double electrometric titration with lactic acid and hydrochloric acid; 3) partial extraction by ether; the technique of each of these methods is described in detail. They further carried out experiments on the influence of the adsorption of lactic acid by the casein and studied the effect of certain factors on the free lactic acid content and on the coagulation point of the casein in sour milk.

RESULTS. — 1) In sour milk most of the lactic acid is present as lactate. Part of the free acid is in solution while a smaller part is adsorbed by the casein. A Freshly separated skim-milk, pasteurised at 62° C., cooled to 25° C., and inoculated with *Bacterium lactis acidi* showed no appreciable quantities of free lactic acid until 20 hours after inoculation (there were then 0.1 cc. of acid in 0.1/N solution in 100 cc. of milk ; this amount then increases fairly rapidly, amounting to 20 cc. after 48 hours).

2) In milk soured at 25° C after undergoing various treatments (pasteurised milk inoculated with *B. lactis acidi* or *Bacillus bulgaricus* or *Streptococcus lacticus* ; inoculated unpasteurised milk ; etc.) the *total* acidity varies from 70.5 to 229 cc. of 0.1/N acid per 100 cc. of milk ; the *free* lactic acid from 8.6 to 104 cc. ; the acid as lactate from 51.8 to 92 cc. ; the *hydrogen-ion concentration* from 3.70 to 4.56. In milk soured under ordinary conditions, the *total* acidity varies from 70.5 to 107.5 cc. ; the *free* lactic acid from 13.1 to 34.5 cc. ; the *hydrogen-ion concentration* from 4.02 to 4.43.

3) About 20 % of the free lactic acid is absorbed by the casein in coagulated sour milk and the milk casein begins to coagulate when the hydrogen-ion concentration reaches 4.64 to 4.78. The time from beginning to end of coagulation varies from 30 to 60 minutes, during which time the hydrogen-ion concentration remains constant.

4) The first physically and easily perceptible sign of souring in milk is a characteristic smell and taste due to the presence of some volatile compound formed in the souring process and not to lactic acid.

There is no apparent relation between either the hydrogen ion concentration or the acidity by titration and the first sign of this flavour.

1419 — “Renovated” Butter. — *Revue Scientifique*, Year LVI, No. 16, p. 504. Paris August 17-24, 1918.

Whilst increasing the quantity of food stuffs they produce the United States are also attempting to improve the quality and increase the

commercial value. M. G. D'AVENEL gives a significant example of this. Instead of heavily salting their summer butter, the amount of which exceeds the demand, and which is usually mediocre butter not easy to sell, the American farmer has devised what was first called "magic butter", then "boiled" or "sterilised" butter, and which is now known officially as "renovated butter".

The butter is melted as soon as bought on the market by the 80 firms that use the method, then solidified in iced water after 1% of glycerine and 5% of salt have been added, then preserved in closed recipients until winter. To return it, according to the demand, to its original state, the salt and glycerine are carefully extracted by again melting it; it is mixed with 3 times its volume of milk, and the emulsion of butter and milk obtained in this way exactly resembles fresh cream, which is then churned in the usual way. "Renovated butter" is quite pure, since it contains no foreign matter, and, although it is required by law to be labeled "renovated butter", it is nevertheless much in demand on account of its price, more modest than that of choice varieties.

1420 - **The Manufacture of Casein from Buttermilk or Skin Milk.** — DÄRLBERG, A. O., in the *United States Department of Agriculture Bulletin No. 661*, pp. 32 + 9 Figs. + 6 Tables. Washington, April 9, 1918.

The utilisation of by-products by a large number of creameries is daily becoming of more economic importance. Because of the ever-increasing competition, the future success of many creameries depends in no small degree upon both the quality of their products and the extent to which by-products may be profitably utilised.

In the past skim-milk casein is the only kind that has been made in large quantities; a good grade of casein can also be profitably made from buttermilk, when it does not bring exceptional prices for food. It is advisable to convert the buttermilk into food products when proper markets can be obtained, as greater profits can then be obtained. But as it is not always possible to utilise all the buttermilk in this way, it is important to be able to turn the surplus into casein, which keeps perfectly and finds a ready market.

BUTTERMILK CASEIN. — The recovery of casein from buttermilk by the method to be outlined depends on the normal acidity of the buttermilk. The sour buttermilk from the churn, or that which has ripened to the required acidity, is heated sufficiently to cause a rapid separation of the curd and whey. Owing to the fineness of buttermilk curd every precaution must be taken to prevent it from being broken up any finer, which makes handling more difficult. Turning steam directly into the butter tends to break the curd up. The method devised for suitably heating the buttermilk is to run it through a steam jet or ejetor, which gives the desired temperature in a rapid and efficient manner and with very little agitation of the curd. With buttermilk of sufficient acidity a good separation should be obtained at a temperature varying between 115° and 130° F (46.1° and 54.4° C). This method is based on results obtained in devising a method for handling

surplus buttermilk at the Grove City Creamery, Pa., operated under the supervision of the Dairy Division, U. S. Dept. of Agriculture. The method has been thoroughly tried in a commercial creamery, where it is giving most satisfactory results.

Precipitating the curd.—The buttermilk from the churn is pumped into a tank elevated sufficiently to allow it to run by gravity through an ejector and from there into another tank below, whose gate valve is high enough to let the drain rack run under it. To save time, the heating should be done quickly. A valve placed in the buttermilk pipe leading from the tank to the ejector, and one in the steam pipe next to the ejector, permit easy control of the temperature to which the buttermilk must be heated to obtain proper separation. While conclusive data bearing on the acidity required for the most favourable results have not been obtained, an acidity of from 0.65 to 0.80% at the time of precipitation apparently gives the best working conditions. Buttermilk kept too long and highly acid tends to give a soft, sticky curd difficult to handle, especially when a high precipitating temperature is used. By varying the temperature used the proper degree of heat necessary to get good results may be obtained. At that temperature the buttermilk coming from the ejector is in such a condition that the curd rises quickly to the top, leaving the clear whey below. As soon as the curd has massed at the surface, which requires only a few minutes, the greater portion of the whey can be drawn from the bottom of the vat into the cloth-lined drain rack. The clear whey passes through the drain cloth quickly and by gradually closing the gate valve as the curd lowers in the vat, nearly all of it can be drained away. When the whey has drained away, the hot curd is placed on the drain racks ready for washing. The curd is washed at least twice with cold water, using a shower-bath spray nozzle. The drainage water should test less than 0.20% acidity, which is possible with two washings. The curd is placed in a form made of 1 inch surfaced material 20 in. square and 8 in deep which is lined with 2 press cloths; the cloths are turned over from both sides so as to hold the curd securely when pressure is applied. The curd is pressed heavily until the curd is sufficiently dry for satisfactory grinding. The dry curd is ground finely, then dried. Fine-mesh screening must be used for the drying trays, as the buttermilk casein is very fine, not flaky like that made from skim milk by the addition of commercial acid. The curd is then spread uniformly over the drying trays by means of a simple shaker screen, like those used for screening sand.

The time required for proper drying depends on the condition of the curd, the uniformity of the spreading on the trays, and the volume and temperature of the air passing over the curd. The volume and speed of the air blowing over the curd should not be excessive, but sufficient to carry off the moisture readily. If the air current is too swift the dried casein is blown off the trays. A temperature of 130° F (54.44°C) is sufficiently high for all purposes. Casein dried at that temperature comes from the drier in a fine-grained condition and breaks up easily, while that dried at a higher temperature tends more to cake in one mass and is harder to grind to the same

degree of fineness. High temperatures may give casein that is more difficult to dissolve or discoloured. The casein can be dried completely at 103° F., provided that the curd has been properly ground and spread upon the trays in the proper manner.

The best type of drier is made of tongue-and-groove boards nailed both sides of the studding, the space between being filled with insulating material. The tunnels should be lined with galvanised iron if they are to be used continuously as the hot air dries the boards out. The double tunnel drier is the most economical. The tunnel should be 1 inch wider than the trucks and drying trays. Many tunnels are made 31 or 32 inches wide to take the 30 in. square drying trays that can be bought ready made. The tunnels used in these experiments were 24 in. wide. A double-tunnel drier, 22 ft. long, 5 ft. high, and each tunnel 24 in. wide will hold trays filled with the casein from 20 000 lb. of buttermilk. The driers can be made of any length and height but should be high enough to allow a man to walk in and out easily when pushing the trays.

A blower of sufficient capacity to send a large volume of heated air over the ground curd is required. Details are given for the construction of the drying trays and trucks, the curd mill, the curd press, the drain rack (like those used in the manufacture of cottage cheese) and other accessories.

It is advisable to grind and screen the casein after it comes from the drying tunnel in order that it may be of uniform grain and appearance; after it is shipped in strong sacks.

On the average 100 lb. of undiluted buttermilk yield on the average from 2.8 to 3.1 lb. of dried casein. In many creameries the cream is diluted with too large a quantity of water before churning, thus giving lower yield of casein.

No definite figures can be given on the cost of manufacturing, as cost-accounting data were not kept that could give results applicable to ordinary creamery conditions. If 10 000 lb. of more of buttermilk are handled daily the cost of making dried casein should not exceed 3 cents per lb. in the U. S.

The factors that have an important influence upon the quality of the buttermilk casein are:—the fat content of buttermilk; washing the precipitated curd; temperature of drying the ground curd; temperature of precipitating the curd; acidity of buttermilk at the time of precipitation. These factors are considered separately. Since the fat originally in the buttermilk is concentrated in the dried casein, it probably has a deleterious effect upon the strength and general working properties of the casein. An increased quantity of fat yields a casein of poorer solubility and strength. The effects of these various factors are shown in a number of tables.

SKIM-MILK CASEIN.—This is usually made by adding crude commercial sulphuric acid to the fresh skim milk after heating the latter to a temperature of 120° F. (48.8° C.). The advantage of this method is that the skim milk can be disposed of quickly and at a time when the quality of the curd is in the best condition.

The skim-milk is heated directly by steam in a wooden vat to 120° F., never above 125° F. Commercial sulphuric acid (1.83 specific gravity)

is then added at the rate of one pint to every 1,000 lb. of milk, at the same time stirring the mixture continuously. Before using, each pint of acid should be diluted with about a gallon of water. After adding the acid the skim-milk is stirred gently until the curd is well separated, which takes only a few minutes. If the curd does not separate well more acid may be added. The clear whey is run off and the curd remaining in the vat is rinsed with cold water to remove the excess of whey and acid remaining. The curd is then placed in the burlap or duck press cloths and put to press till sufficiently dry. The curd is then ground, placed on the trays and dried in the tunnel drier.

The cooked-curd method of making skim-milk casein, requiring practically no equipment save the precipitating vat, is coming into general use among creameries near to a central drying plant. The skim-milk is heated to 120° F. and sulphuric acid added to coagulate the casein, as described above. After draining off the whey the curd is broken up in the vat, covered with water, and the mixture heated to 170°-175° F. (76.6° to 79.44°C.) by means of direct steam. At that temperature all the curd should collect in a semifluid, plastic, tough mass. The water is drained off and the soft curd placed in a barrel, where it settles into an almost air-tight mass which on cooling changes to a very tough impervious mass that will keep for several days, even in hot weather. The barrels filled with cooked curd and covered with burlap can be shipped to the central drying plant. Cooked curd is hard to grind and requires an especially strong mill.

Casein can be made successfully from skim milk with the ejector method of precipitating the curd, but care must be taken in allowing the skim milk to curdle before heating, or a tough, rubbery curd, impossible to handle, will result. The curd from naturally soured skim milk, separated by the ejector method of heating, is not only handled as easily as that precipitated with sulphuric acid but is not nearly so tough nor so hard to grind.

From 100 pounds of average skim-milk between 3 to 3.25 lb. of casein can be obtained.

After describing the requirements for good casein (especially its solubility, adhesiveness, and general working qualities), the author considers the casein markets and prices.

A few years ago casein cost from 5 to 7 cents a pound, but during the last 2 years the price has doubled or more; at one time even 22 cents a pound was offered in the United States.

1421 — The Installation and Equipment of an Egg-Breaking Plant. — JENKINS, M. K., in the *U. S. Department of Agriculture, Bulletin No. 663*, 25 pp. + 25 Figs. + 2 Photographs + 2 Tables + Bibliography of 5 Publications. Washington, May 27, 1913.

The aim of this bulletin is to assist manufacturers of preserved liquid eggs to make a judicious choice of apparatus and to instal their plant so as to prepare the preserves hygienically and, at the same time, assure the maximum economy of space and labour. A modern plant of this kind must contain a chilling room for whole eggs, a candling room, a chilled room for breaking the eggs and removing the contents from the shell, a room for wash-

ing and sterilising the utensils used for breaking and separating, and a refrigerating room for the rapid freezing of the liquid eggs and their storage.

A plan shows the arrangement of the different rooms. It provides for a staff of 12 breakers and a daily output of 120 cases if the white and the yolk are separated and of 180 cases if the eggs are preserved whole. A skilled worker may prepare 12 to 15 cases of whole eggs daily and 8 to 10 cases if the white is separated from the yolk. The temperature of the rooms varies according to the purpose for which they are used. The temperature of the chilling room should be from 32 to 40°F., that of the candling room from 50 to 55°, of the breaking room from 60 to 65°, the sterilising room normal and that of the refrigerating room from 0 to 10°F. All the rooms should be suitably insulated. The breaking and sterilisation rooms should receive plenty of natural light from windows. The walls and ceilings of these two rooms should be plastered and white enamelled and the floors concrete with trapped drains. Between the two rooms should be a sliding window for the transfer of equipment. The refrigerating room should be equipped with shelves of piping through which passes the brine for freezing the cans of liquid eggs. The shelves should be 20 in. wide and about 15 in. apart.

The candled eggs are removed to the breaking room in metal pails. Leaking eggs after candling are placed in special square trays (made of galvanised iron with an iron plate perforated to hold 36 eggs; it is 12 $\frac{1}{4}$ in. square and 3 $\frac{1}{2}$ in. high) for removal to the breaking room. The apparatus used in the liquid egg preserving industry must, like that of dairies, be made of material which washes easily and does not rust.

The eggs are broken into glass cups which make it easy to see which eggs should be rejected. The cups should be of thick glass capable of holding two eggs but not more; sometimes only one egg is broken into each cup. The cups are placed on a special metal tray fitted with a detachable knife on which the eggs are broken. The knife rests in slots in standards fastened to the ends of the tray. When the white is separated from the yolk this should be done by a sanitary mechanical device. The tables should be covered with non-absorbing material, such as metal or porcelain. A full list of the requisite apparatus is given in a table; part of it may be bought ready made, but part must be made to order.

Before freezing liquid eggs the whites and the yolks must be mixed in a special churn fitted with a motor-driven paddle. This is one of the most important pieces of apparatus in the breaking room. Two types of churn are at present in use, one chills the eggs to nearly freezing during the churning process, the other simply mixes the eggs. The first type is indispensable in establishments having no adequate refrigeration system for cooling the eggs before breaking and rapidly freezing the liquid eggs. Holding the eggs at a warm temperature, even for a few hours only, causes a rapid multiplication of bacteria. The refrigerating churn most commonly used is a modified pasteurising machine which may be bought from dairy supply firms. Non-refrigerating churning are also described and illustrated by figures. It is essential that the churn be made so that it may be rapidly washed and sterilised. The sterilising room must contain sinks for washing the utensils,

and sterilisers. The sinks must be fitted with mechanical rinsers and drains.

Frozen liquid eggs are usually sold in 30 lb. tins, but sometimes in 20, 10 or 5 lb. tins, especially in the case of the whites of eggs.

1422 - Microorganisms and Heat Production in Silage Fermentation (1). — HUNTER, O. W. (Dairy Bacteriologist, Kusas Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 75-83 + 10 Figs. + Bibliography of 15 Publications. Washington, July 9, 1917.

Different workers disagree as to the cause of heat production in silage. Some consider it to be due to respiration of the tissue cells, others to respiration of tissue cells and microorganisms and others to microorganisms alone. In order to solve this problem the author ensiled maize, alfalfa, sugar cane and kafir under the following conditions: — 1) normal, natural fermenting forage; 2) forage treated with antiseptic; 3) forage treated with heat; 4) forage treated with heat and inoculated with bacteria; 5) dried forage.

Heat production occurred in the untreated and inoculated forage; in the other cases the rise in temperature was due to heat absorption. Dried forage undergoes normal fermentation when water is added. Heat production in silage is, therefore, due to bacterial activity and not to respiration of the tissue cells.

1423 - The Cork Industry. — BARRIS, in *Le Chêne-Liège*, Year XXIV, No. 63. Bone (Algeria), September 15, 1918.

Report by the author, Financial Delegate on the Committee of the Councillors for Foreign Trade at the French Ministry of Commerce and the General Government of Algeria, dealing with the general question of Algerian and French corks and its relation to other countries.

WORLD'S CORK PRODUCTION. — Cork production is strictly limited to the Western Basin of the Mediterranean and the Atlantic coasts of the Iberian Peninsula and South-West France. Expensive attempts have been made to plant the cork-oak in many places (California, Australia, the Cape, Japan, etc.), but with wholly negative results. Countries having forests of this tree thus enjoy a natural monopoly.

The appended Table shows that Algeria alone furnishes nearly $\frac{1}{3}$ of the world's production; France, Algeria and Tunis together furnish just over $\frac{2}{3}$ of that production, without including Morocco, where there are vast forests that will soon be exploited. The cork industry is very little developed in France and it practically does not exist in Algeria.

WORLD'S CORK MARKETS. — The greatest consumers of unworked cork, not including France, are: — England, Russia, Germany, Austria-Hungary and the United States. The four last-named countries admit unworked or slab cork duty free and subject worked cork to heavy duties to protect the home industries. England is the only one of these nations that admits both raw and worked cork duty free, but the cork comes mostly from Portugal and Spain.

(1) See also *R.* July, 1917, No. 650. (*Ed.*)

Area and yield of cork-oak forests.

| | Area of cork-oak forests hectares | Yield in cork of these forests quintals |
|-------------------------|---|---|
| France | 150 000 | 120 000 |
| Algeria | 426 000 | 419 000 |
| Tunis | 82 000 | 50 000 |
| Italy | 80 000 | 40 000 |
| Spain | 250 000 | 275 000 |
| Portugal | 300 000 | 425 000 |
| Morocco | note | note |
| <i>Totals</i> | 1 395 000 | 1 359 000 |

UNWORKED CORK. — The following countries imported the following amounts (in quintals) of raw cork in 1913: — France, 66 000; Russia, 72 000; Germany, 58 000; Austria-Hungary, 56 000; Belgium, 35 000; Netherlands, 22 000; United States, 55 000; Spain, 30 000; England, 9 000; Sweden, 4 000; Denmark, 4 000; Italy, 2 000; Japan, 2 000.

The exports of raw slab cork from Algeria into France are sent for to be partly turned into worked products. France re-exports part of the Algerian cork as well as part of the home product in the raw state, while she has to import worked cork, which shows the inferiority of her bottle-stopper industry, although France is the most important market in the world for the worked products, on account of the large amount of wine bottling carried on.

The countries of central Europe, Belgium, the Netherlands and the United States appear to have taken the first place on the Algerian cork market.

The exports of male cork, debris, etc. preponderate in this trade. The exports to Central Europe and America mostly consist of these products, used for making cork powder, agglomerates, now so much used, and linoleum.

On considering market cork only, it is seen that the above-mentioned countries hold a good place, but it will be found that France and Russia absorb $\frac{2}{3}$ of the good Algerian cork, while the great mass of the by-products and inferior qualities is taken by the Austro-German and American trade which transforms it, reexporting a part after manufacture.

WORKED CORK. — The Algerian exports of worked cork are so far very limited. In 1913 they reached 6500 quintals, and represent the product of about 10 000 quintals of raw cork. About 70 % of these exports goes to France, while the rest goes to Central Europe, especially Austria-Hungary, whose importations through Adriatic ports are gradually increasing.

THE ALGERIAN INDUSTRY. — This is quite rudimentary, only working 10 000 quintals in the best year (1913).

There was a double reason before the war for this state of affairs. On the one hand, the local consumption is small and will only increase

slowly in the future. On the other hand the big cork-consuming and non-producing countries have taken measures to assure that the cork will be transformed into worked products in the importing country by placing light duties on unworked cork and very heavy, if not prohibitive, duties on worked cork (save Great Britain).

The author points out the necessity for France to obtain, after the war, free trade between all countries for worked cork or, at any rate, equality as regards import duties for all corks in all countries.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1424 - **New and Rare British Fungi.** — WAKEFIELD, E. M., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 7, pp. 229-233. London, 1918.

Among the seven species of fungi observed in Great Britain from 1916 to 1918 and recognised as new to science or to the mycological flora of the country, the following deserve special mention: —

1) *Merulius Pinastri* Burt., found in abundance at the Botanical Gardens at Kew in September, 1917; the conditions in the greenhouses are so favourable to its development that at times it becomes almost a pest.

2) *Nectria fusco-purpurea* u. sp., observed at Wisbech in 1917 on dead branches of Pond's Seedling plum trees; there is no evidence that this fungus caused the death of the branches, but it was not found on any other variety of plum.

3) *Cercospora Antirrhini* n. sp., reported from Worcester (September, 1917) and from Birmingham (June, 1918) as damaging *Antirrhinum*, the leaves and stems of which it attacked.

4) *Mastigosporium album* var. *muticum* Sacc., on leaves of *Dactylis glomerata* at Oxshott (October, 1917) and at Kew (1918).

5) *Helminthosporium Warpuriae* n. sp., on an injured stem of *Warporia clandestina* at Kew in July, 1917; this fungus appears to belong to the class of facultative parasites, having entered the plant through a wound; it grew there parasitically, but probably as a rule it is a saprophyte and would not attack an uninjured plant.

1425 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 1406 of this Review.

1426 - **Diseases Reported on Wheat in Java.** — PALM, B., in the *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 34, pp. 1-21 + 12 Figs. + 1 Plate. Batavia, 1918.

In 1918 the Department of Agriculture, Industry and Commerce conducted wheat growing tests in the high and low regions of Java. In the high regions, the results were, as a rule, satisfactory, save for the fact that a more or less large number of wheat plants of different varieties (the tests had been carried out with wheat varieties from Europe and India) was attacked by fungous diseases amongst which *Ustilago Tritici* (Pers.) Rostr. and *Gibberella Sambuctii* (Dur. and Mont.) Sacc. = *Fusarium rostratum* Appel and Wollenw. are of considerable importance. The diseases were probably introduced with wheat grains as they were previously unknown in

Java. Since then, *Helminthosporium gramineum* (Rab.) Eriks. (?), *H. geniculatum* Tracy and Farle, and *Nigrospora Panici* Zimm. have been recorded as injurious. The author is as yet unable to say whether the two *Helminthosporium* diseases originated in Java; he is, however, of that opinion, as he has occasionally found both the species on maize. *Nigrospora Panici* has been long known in Java.

1427 - *Uromyces pedicellatus* n. sp., a Rust Injurious to *Eragrostis abyssinica* and *E. curvula* in the Transvaal. — POLE EVANS, I. B., in the Royal Botanic Gardens, Kew, *Bulletin of Miscellaneous Information*, No. 7, pp. 228-229 + 1 Fig., London, 1918.

According to observations made by the author at Pretoria, Transvaal, the stems and leaves of *Eragrostis abyssinica* Link. (= *Poa abyssinica* Jacq.), locally known as "teff", are very seriously attacked in South Africa by an *Uromyces* which does not appear to have been described hitherto. The leaves and stems of *E. curvula* Nees are also frequently attacked by an *Uromyces* differing slightly from *U. Eragrostidis* Tracy, already described on *E. pectinacea* Nees in North America and on *E. cynosuroides* Beauvo. in India. The *Uromyces* on *E. curvula* is identical with that on *E. abyssinica* and it seems not improbable that the rust which attacks *E. abyssinica* in South Africa has passed on to it from *E. curvula*. The author describes this rust under the name of *U. pedicellatus*.

1428 - *Cronartium occidentale* n. sp., a Rust Injurious to *Pinus edulis*, *P. monophylla*, *Ribes* spp. and *Grossularia* spp. in Colorado and Arizona, U. S. A. — HEDGECOCK, G. G., BETHEL, E. and HUNT, N. R., in the *Journal of Agricultural Research*, Vol. XIV, No. 10, pp. 411-421 + 1 Fig. + 1 Plate, Washington, December 2, 1918.

The authors describe as a species new to science *Cronartium occidentale*, a parasite of *Ribes* spp. and *Grossularia* spp. This rust has been observed in Colorado for many years and also in Arizona and seems to have been found in Kansas on *R. aureum* before being reported from the other two States. By means of cultures it has recently been found possible to grow it on *Ribes* spp. and *Grossularia* spp. even in the Columbia district (Washington).

Repeated inoculation experiments have shown the accidial stage of this fungus to be represented by a species of *Peridermium*, at present known as *Per. occidentale*, which has so far been found on 42 *Pinus edulis* trees in five different districts of Colorado and on one *P. monophylla* near Prescott, Arizona. These two pines, together with *P. cembroides*, which is probably also a host of *Per. occidentale*, and *P. quadrifolia*, are known as "piñon" pines. As this rust has only been observed on the trunks and branches of piñons and, so far as is known, does not attack other pines, it has been called piñon blister rust. In the various districts of Colorado and Arizona in which *Cron. occidentale* has so far been observed the common host of the urediniospores and teliospores is *R. aureum*, although both these forms are sometimes found on *R. odoratum*, *R. inebrians*, *Grossularia reclinata* × *Gr. hirtella* and *Gr. leptantha*.

Cron. occidentale was inoculated with positive results into *R. americana*.

num, *R. aureum*, *R. coloradense*, *R. Giraldi*, *G. glandulosum*, *R. malvacium*, *R. nigrum*, *R. odoratum*, *R. sanguineum*, *Ribes* sp., *Gr. inermis*, *Gr. missouriensis* and *Gr. declinata* \times *Gr. hirtella*.

Cron. occidentale, which differs from *Cron. ribicola* in the aecidial stage especially, seems capable of over-wintering on *R. aureum* and remaining independent of the aecidial stage.

Per. occidentale is rarely found, at a certain distance above the soil, on very old *P. edulis* trees, and occurs in the crevices of the bark, often without adjacent dead areas. In such case the fungus is hardly discernible, even with a hand lens. Its effects are clearer on young trees, a number of which, apparently killed by the fungus, have been found in South Colorado. They are usually attacked on the trunk and branches near the soil, some becoming spike-topped. Plants of *Ribes* and *Grossularia* attacked by *Cron. occidentale* seem to suffer but slight injury. If the attack is severe partial loss of leaves will result, and repeated attacks may cause stunted growth, but no trees killed by this fungus have been found.

WEEDS AND PARASITIC FLOWERING PLANTS.

1429 - **Orchid Parasitic on the Leguminous Plant *Caesalpina coriaria*, in the Dominican Republic.** — See No. 1363 of this Review.

1430 - ***Sorghum halepense*, a Weed in Porto Rico.** — STEVENSON, J. A., in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 132-135 + 2 Figs. San Juan, Porto Rico, 1918.

The presence of *Sorghum halepense* (Johnson grass, "yerba de don Carlos" or "canuela") is reported from Porto Rico. The grass has been noted in various places in the neighbourhood of Rio Pedras and is fairly common in the pineapple-growing zone near Vega Baja; it is certainly present in other parts of the island. The weed has begun to spread largely in the pineapple plantations, causing considerable damage.

As regards means for controlling the grass, the first precaution is to avoid bringing it into the fields as a forage crop, because the disadvantages resulting from its great tendency to spread and the difficulty with which it is extirpated once it has taken root are much greater than its value as food for cattle.

If the plant has already spread in a field radical measures must be taken at once; and seed formation must be avoided at all costs. It must be removed by tearing up its rhizomes; after a few weeks the operation should be repeated to destroy the plants produced by the pieces of rhizome remaining after the first removal.

When the plant has already taken possession of a considerable area the rhizomes will have to be removed for some years in succession; but the author thinks there will be no need for such an extreme measure at Porto Rico. In this case, however, the plant should be kept level with the soil by using the ground two or three years in succession for the production of cut forage. Then, after a light ploughing, some crop should be grown that

requires the use of a cultivator. With a little more effort, by extirpating the plants of *S. halepense* as they emerge from the ground, the work will be crowned with complete success.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1431 - **Enemies of the Chinch-bug (*Blissus leucopterus*), Observed in Illinois, U. S. A. (1).** — FLINT, W. P., in the *Journal of Economic Entomology*, Vol. XI, No. 5, pp. 415-419. Concord, N. H., 1918.

Up to now it has usually been supposed that the enemies preying on the chinch-bug were only of very limited efficacy in limiting the ravages of that insect. Observations made in Illinois during the recent plague there of this hemipteron (1909-1915) show the contrary however.

The enemies most commonly found feeding on *Blissus leucopterus* in the infected zone were adults and nymphs of the damsel bug (*Reduviulus ferus*), larvae of *Chrysopa* and *Hemerobius*, adult *Blechrus glabratu*s and *Bl. pusio*, nymphs and adults of *Pagasa fusca*, larvae of various species of Coccinellidae, nymphs and adults of the flower bug (*Triphleps insidiosus*).

Casnonia pennsylvanica feeds on small numbers of the bug, while *Agonoderus pallipes* eats the dead bugs and their moulted skin.

Ants were never seen to attack the living insect.

Judging from the abundance of enemies in the fields infested by *Blissus leucopterus*, and the numbers of the latter eaten by them it is probable that when, after a period of abundance, the development and spread of the hemipteron are stopped by weather conditions, their enemies, with *Eumicrosoma benefica* (parasite of the eggs of *Blissus*), might even prevent the pest from becoming harmful for some years. Thus, over a large area of Illinois, infested by chinch-bugs, no damage was noted in 1917, which is partly due to the abundance of predatory species in the fields. *Red. ferus* and *Pag. fusca* were extraordinarily abundant in fields infested by *Bl. leucopterus* during the summer of 1918.

1432 - **Parasites of *Portheretia dispar* (Gipsy Moth) in Spain (2).** — MERCET, R. G., in the *Revista de Montes*, Year XLII, No. 1004, pp. 775-781 + 2 Figs. Madrid, 1918.

The larvae of the gipsy moth (*Portheretia dispar* L.) — known in some districts in Spain under the name of "lagarta" and very injurious to oaks, whose leaves it eats — are spreading alarmingly in the neighbourhood of Madrid (Casa de Campo, El Pardo and Puerta de Hierro).

However, the macrolepidopteron is not exempt from parasites in Spain. The following chalcids, parasitic on its eggs, are described briefly by the author:—

1) *Anastatus bifasciatus*, very abundant and one of the most efficacious enemies of the gipsy moth;

2) *Schedius kuwanae*; not less efficient than the preceding one;

(1) See R., June 1914, No. 588; R., July, 1915, No. 768. (Ed.)

(2) See R., May, 1911, No. 1568; R., August-September-October, 1911, No. 3025; R., March, 1916, pp. 330-331. (Ed.)

3) *Alopomoidea ogimae*, not very abundant. In addition there exists in Spain a new species *Tyndarichus* which might perhaps replace *Tynd. navae* among the chalcids parasitic on the eggs of the gipsy moth.

1433 - *Apanteles lacteicolor* and *Meteorus versicolor*, Hymenoptera Parasitic on the Brown-Tail Moth (*Euproctis chrysorrhoea*), Imported into the United States from Europe (1). — MUSEBECK, C. F. W., in the *Journal of Agricultural Research*, Vol. XIV, No. 5, pp. 191-206. Washington, July 29, 1918.

In the winter of 1905-1906, as the result of arrangements made by the Washington Bureau of Entomology for the importation from Europe into New England of parasites of *Portheria dispar* (gipsy moth or bombyx disparate, spongy, zigzag) and *Euproctis chrysorrhoea* (brown-tail moth), a large number of winter webs of the second species were sent from Massachusetts to the special laboratory, then at North Saugus, but moved later to Melrose Highlands. This material was placed in special tubes, and, at the beginning of the following spring, were observed in the tubes numerous specimens of *Pteromalus egregius*, a chalcidoid ectoparasite of the wintering brown-tail moth larvae, as well as many specimens of *Monodontomerus aereus* Walker, another chalcidoid which often hibernates in the adult stage in the web of the moth. The moth larvae soon became active. As it seemed unlikely that these larvae should be the hosts of endoparasites they were removed from the tubes and destroyed with the exception of a few which Mr. E. S. H. TITUS, who was then directing the investigations, continued to feed for a certain time. From these larvae were obtained two braconid parasites, one belonging to the genus *Apanteles*, the other to the genus *Meteorus*.

As the result of the discovery made by Mr. TITUS, the moth larvae in webs received in America during succeeding winters were not destroyed when they emerged in spring, but were fed for several weeks in order to rear out any endoparasites they might contain. This method was followed till 1911, when importation was stopped. There were then available for distribution in localities infested by the brown-tail moth about 40 000 cocoons of *Apanteles lacteicolor* and 1 600 of *Meteorus versicolor*. These species are widely distributed in Europe, both having been obtained from moth webs sent from France, Holland, Germany, Russia (especially South Russia), Austria, Switzerland, and Italy. The spread of the parasites has been so rapid that, although only 150 colonies of *Apanteles* and 20 of *Meteorus* have so far been distributed in 135 and 18 localities respectively, no further colonies are required. Both parasites have been recovered from the whole brown-tail moth area either by rearing the moth larvae in spring or by dissecting the hibernating larvae.

The two braconids which hibernate in the brown-tail moth larvae, *A. lacteicolor* and *M. versicolor*, were first described by VIERECK and WESMAEL in 1911 and 1835 respectively. A more complete description of the adults of both species is now given and their biology discussed in detail.

(1) See *R. Aug.-Sept., -Oct. 1911*, No. 3025; *R. Nov.-Dec., 1911*, No. 3252; *R. March, 1916*, pp. 330-331. (*Ed.*)

A. lacteicolor is of great importance as a means of control. It is such an efficient parasite that 20 to 25 % of brown-tail moth larvae in a wet are often attacked. Its value is increased by the fact that, in America, it has several generations a year and is a more or less important parasite of the gipsy moth and other native injurious species. Moreover, *A. lacteicolor* destroys its hosts in their early stages, preventing them from doing any serious damage by considerably delaying their development. The weak point in the life cycle of *A. lacteicolor* is its evident dependence on the brown-tail moth for hibernation. The moth is now beginning to disappear so that *A. lacteicolor* is becoming gradually less abundant, thus materially reducing its parasitism on *Porth. dispar* and other native hosts.

M. versicolor is much inferior to *A. lacteicolor* as a parasite of the hibernating brown-tail moth larvae of which it only destroys a small percentage. On some occasions cocoons of *M. versicolor* have been found in enormous numbers in serious brown-tail moth infestations, but these cases are rare. Moreover, parasitism on the almost full-grown brown-tail moth larvae is slight, and that upon native larvae appears almost insignificant. The slight importance of this parasite as compared with *A. lacteicolor* is probably largely due to its dependence on the brown-tail moth for hibernation, and the fact that it, in its turn, is exposed to attack from various parasites. Another factor reducing the importance of this *Meteorus* is the frequent failure of the larvae to transform to pupae when they have spun cocoons. When *A. lacteicolor* larvae occur in the same hibernating brown-tail moth larvae as *M. versicolor* they cause the death of these latter.

1434 - The Control of *Cylas formicarius*, a Coleopteron Attacking Sweet Potatoes, at Porto Rico (1). — SMYTH, E. G., in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 136-139. San Juan, 1918.

At Porto Rico *Cylas formicarius* ("gorjojo de la batata" or "gorjojo de la rafz de la batata"), which has been present in the island for a long time sometimes destroys more than 75 % of the sweet potato crop and make it impossible to continue cultivating it. The injury is done by the larva and the adult which hollow galleries in the root, making it unfit for consumption.

When new plantations are formed it is important to be certain that the insect is neither present in the soil nor introduced in the cuttings used. If it be doubtful that the plants from which cuttings are to be made are free from the parasite cuttings must be made from healthy plants which have been previously fumigated with carbon bisulphide and placed in a nursery at a distance from infested plantations.

It is very difficult to free a heavily infested, large sweet potato plantation from the insect. The only method is to harvest all the tubers as soon as the pest is discovered; the longer this is delayed the more difficult will

(1) See *R.* March, 1911, No. 1058; *R.* April, 1911, No. 1319; *R.* Jan., 1916, No. 124; *R.* Aug., 1918, No. 436. (*Ed.*)

it be to destroy the insect completely. When harvesting the roots care must be taken to leave no infested ones on the ground or the crop next grown in the same soil will be infected. Potatoes suitable for sale must be immediately removed from the field, and those to be used for propagation fumigated without delay. Attacked tubers which have no market value may be first boiled to kill the adult and larval stages of the insects and then fed to stock. Tubers which are useless even as cattle-food should be burnt or buried deeply, care being taken to leave none of them above soil. All the stems should, at the same time, be heaped up and given to stock, or pigs may be turned into the field till all the stems are eaten. By no means should pigs be turned into the field as soon as the marketable potatoes have been sold. The tubers infested by the insects, which are precisely those which should be destroyed are refused by pigs and, being left on the ground, cause new infestation.

1435 - *Pectinophora gossypiella*, a Microlepidopteron Injurious to Cotton in Egypt (1). — See No. 1356 of this Review.

1436 - Observations on the Coleopteron *Lasioderma serricorne* and the Lepidopteron *Setomorpha margalaestriata*, Injurious to Tobacco, in the Dutch East Indies (2). — KRECHENIUS, F. E., in the *Mededeelingen van het Besoekisch Proefstation*, No. 26, pp. 1-56 + 1 Plate, 1917.

Publication of the author's work on *Lasioderma serricorne* ("tabaksboek"), and *Setomorpha margalaestriata* ("tabaksmot") and the means of controlling them.

L. serricorne is attracted to lamp-light, and this property may be used in controlling it; molasses also attracts this insect. In tobacco the adult lives 25 days; the female produces about 30 eggs. About 1 $\frac{1}{2}$ months are required for the insect to become full grown. The incubation of the eggs requires from 4 to 14 days; the larval stage lasts from 30 to 60 days and the pupal stage about 12 days. This *Lasioderma* is omnivorous, it attacks many products, the finest qualities of tobacco being chosen by preference. By placing the insect in a room heated to 60°C. for 20 minutes, all stages of its development are killed. A temperature of about 80°C. for 7 days has the same effect. A temperature of about 90°C. for 5 consecutive days does not kill the eggs, but kills the larvae, pupae and adults. Experiments made with low temperatures have shown that both eggs and larvae of the insect can survive a moderately cold winter.

The following observations regarding *Set. margalaestriata* are given by the author: — This Lepidopteron occurs in Java and Sumatra. Besides tobacco it attacks tobacco seeds, clothes, leather and dried coca leaves. The female lays from 100-150 eggs; the life cycle requires from 40-60 days.

(1) See *R.*, Nov. 1918, No. 1309.

(2) See *R.*, Nov. 1914, No. 1081; *R.*, May 1916, No. 500; *R.*, June 1916, No. 711; *R.*, Dec. 1917, No. 1261. (Ed.)

The egg hatches in from 7 to 8 days, the larval stage lasts from 3 to 5 weeks and the pupal stage 14 days. A temperature of 40°C for 5 hours kills the insect in all its stages; a temperature of 0°C. for 5 days has the same effect. It may thus be concluded that the insect could not survive the winter in a temperate region. The author mentions a few means of control and discusses the results obtained with them. As measures to take for avoiding infection all the tobacco barns should be paved with concrete, the barns should be disinfected and all the tobacco or other products liable to attack and intended for export should be fumigated with carbon bisulphide. The disinfection should take place 5 days before embarking, so that the carbon bisulphide can escape completely. The Dock and Shipping Companies must be forbidden to place disinfected goods along by infected goods. Tobacco destined to the Colonies should be disinfected in Holland and in the other exporting countries.

1437 - *Clytus devastator*, a Coleopteron Injurious to Citrus and Other Plants, in Cuba and Florida. — BACK, B. A., in the *Journal of Economic Entomology*, Vol. XI, No. 5, pp. 411-414 + Plate. Concord, N. H., 1918.

The cerambycid beetle *Clytus devastator*, first described in 1836 by DELAPORTE DE CASTEINAU and GORY as a serious pest of lemons in Cuba, has, of recent years, been also reported from Florida as a pest of citrus and other plants. In Cuba, specimens of the insect have been bred out at Cayamas in 1910 from Cuban mahogany while other specimens have been taken at Central Constancia. The beetle has been observed in the following localities between 1903 to 1910: — Palm Beach, Key West, Paradise Key, Chase and Perico Island, near Anna Maria Key at the entry to Pampa bay. The specimens from Chase were bred out from the pomegranate tree; that of Paradise Key was taken flying. Although at first recorded as a dangerous pest of *Citrus* in Cuba, the insect was only bred out from *Citrus* in the spring of 1910 in Perico Island, when its larvae caused serious damage to the orange trees by hollowing out galleries in the trunk and branches. According to E. A. SCHWARZITS favourite host is *Rhizophora Manel*.

The author calls attention to this beetle which might seriously harm the Florida citrus trade.

1438 - Pests of Stored Food-stuff, in Java. — KEUCHENHOF, P. B., in *Teymannia*, Year XXIX, Pt. 4, pp. 216-221. Batavia, 1918.

The author has drawn up a list of the pests recorded in the foodstuffs stored in Eastern Java: — *Lasioderma serricorne*, *Setomorpha marginalis*, *Aracocerus fasciculatus*, *Rhizopertha dominica*, *Tenebriooides mauritanicus*, *Silvanus surinamensis*, *Calandra oryzae*, *Tribolium castanicum*, *Gonocophalum hoffmannseggii*, *Thanerocerus buqueti*, *Necrobia rufipes*, *Lampholocis* sp., *Carpophilus* spp., *Thagora figurata*, etc.

Many of these pests are not very specialised in their choice of food as the same species can often be found in different foodstuffs. Although some species are not always directly injurious to the product — some of them may even be useful, e. g., *Necrobia rufipes* and *Thanerocerus buqueti* which

drive out all the other pests present in the product — they always reduce its value.

The author discusses methods of disinfection. Treatment with steam or low temperatures is always expensive in the East Indies; X rays can only be used where electric current is cheap; carbon tetrachloride is less advisable than carbon bisulphide on account of its price; prussic acid gas, so very poisonous, can only be used for disinfecting loose products; the disadvantages of this gas are: — the great danger it presents to those applying it, the special glass generators required for preparing it, the rapid loss of its toxicity as it is so easily absorbed by the water contained in the products; sulphur dioxide which besides not having a very strong action, has a bad effect on many products (tobacco, cacao, flour, etc.).

In many cases, a high temperature can be used for disinfection especially if the plantation has a drier. If this last method cannot be used, treatment with carbon bisulphide is advisable. This has so far given the best results and has no effect on the quality of the following products: — hybrid coffee, cacao, tobacco, groundnuts, flour, copra, maize, rice and coca; it produces an insignificant change of shade in the berries of *Coffea robusta*. To disinfect a cubic metre in 24 hours 185 cc. are required, and for the same volume in 48 hours 100 cc. suffices, and in 72 hours 80 cc. The method consists in placing the material to be disinfected into a hermetically closed space in which, at the height of the ceiling, saucers containing carbon bisulphide are placed.

[1438]